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NATIONAL CENTER FOR RADIOLOGICAL HEALTH RESEARCH PROJECTS SUPPORTED BY GRANT FUNDS, JUNE 30, 1967

Julius J. Sabo, et al

National Center for Radiological Health
Rockville, Maryland

30 June 1967

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Summary of active Research Project Grants by major program areas and FY 1967 grant funds expended. Publication references are listed as well as a brief description of the objectives of the research.

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NATIONAL CENTER FOR RADIOLOGICAL HEALTH RESEARCH PROJECTS SUPPORTED BY GRANT FUNDS

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JUNE 30, 1967

Authors: J. J. Sabo
E. C. Anderson

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE • Public Health Service

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FOREWORD

In the formation on January 1, 1967, of the National Center for Radiological Health from the Division of Radiological Health, it was realized that a requirement now existed for new areas of program interest, as well as new emphasis on program areas supported by the predecessor Division.

The program areas under which the research projects herein are grouped - page 1 - differ from those used in the June 30, 1966, listing, in order to reflect this broader scope of Center interest.

James G. Terrill, Jr., Director
National Center for Radiological Health

INTRODUCTION

The research project grant program of the National Center for Radiological Health serves several vital functions:

1. Utilizes the scientific competence and talent of the academic community to bear on problems of direct concern to the Center.

2. Acts as a catalyst whereby scientific talent not available in the National Center for Radiological Health contributes to the longer range evaluation of potential health problems and their solutions and aids in the formulation of the Center's overall control program.

3. Utilizes special situations for research which would not be available or would not be feasible with only an in-house research program.

The grants program, therefore, in order to be of maximum usefulness, is in-put into the overall Center's research effort.

The summary of active Research Project Grants is presented by major program areas and in each program area, the total number of active grants is listed, as well as the percentage of total FY 1967 grant funds expended. The pages list the active grants, as well as those no longer active. These terminated grants are marked with an asterisk and are listed since publications were submitted after June 30, 1966; terminated grants without new publications are not shown. Publications received before June 30, 1966 are not listed, since they were included in a previous document. Publication references are listed, as well as a brief description of the objectives of the research. This description is provided as additional information, but is not of necessity complete, due to space limitations.

The appendices are provided for cross reference purposes. Appendix A lists the grants of this publication by geographic areas with the page reference. Appendix B lists the grants numerically with the page reference and Appendix C is an alphabetical listing of the principal investigators by last name and the page reference.

We hope the dissemination of this publication will be helpful to researchers, as well as helpful to those generally interested in extramural research in radiological health.

E. C. Anderson, Chief
Office of Program Planning and Evaluation

J. J. Sabo, Chief
Research Grants Section
Office of Program Planning and Evaluation

SUMMARY OF RESEARCH PROJECT GRANTS
BY PROGRAM AREAS
JULY 1, 1966 - JUNE 30, 1967

PROGRAM AREA	ACTIVE GRANTS	% OF TOTAL FY 1967 GRANTS BUDGET
METHODOLOGY OF EXPOSURE REDUCTION FOR DENTAL AND MEDICAL PRACTICES	5	2.4
DEVELOPMENT OF DOSIMETRY, INSTRUMENTATION AND SYSTEMS	3	2.1
STUDIES OF NUCLEAR PLANT DESIGN CHARACTERISTICS	1	3.0
STUDIES OF ENVIRONMENTAL PATHWAYS	3	5.2
STUDIES OF PROTECTIVE ACTION IN ENVIRONMENTAL CONTAMINATION	4	2.0
STUDIES OF POPULATION EXPOSURE	7	13.0
HUMAN EPIDEMIOLOGY STUDIES	1	Nil
RADIATION BIO-EFFECTS	22	20.5
MECHANISMS OF RADIATION DAMAGE	35	32.2
STUDIES IN BASIC RADIATION PHYSICS & CHEMISTRY	13	12.9
STUDIES OF NON-IONIZING RADIATION	1	0.7
BENEFICIAL APPLICATIONS OF RADIATION	3	4.6
RADIATION CONFERENCES & SEMINARS	2	1.4
TOTAL	100	

SUMMARY OF RESEARCH PROJECT GRANTS
BY PROGRAM AREAS
JULY 1, 1966 - JUNE 30, 1967

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

METHODOLOGY OF EXPOSURE REDUCTION FOR DENTAL AND MEDICAL PRACTICES

RH 00113* A STUDY OF DESIGN CHANGES IN DENTAL X-RAY MACHINES

Albert G. Richards, M.S.
X-Ray Department
University of Michigan
Ann Arbor, Michigan

Descriptor

Major changes were made in the design and location of the transformer, tube and filter of dental x-ray machines. The filter was located in the aperture of the radiopaque diaphragm located within the tube. The tube was located behind, rather than in front of the high-voltage transformer, thus adding internally 8 inches to the focal-film distance. The high-voltage transformer was constructed with a truncated conical opening through it to allow for the passage of the useful x-ray beam. The effect of these changes on image quality and exposure of the patient and operator was investigated.

Publications

Richards, A. G. "New Concepts in Dental X-Ray Machines." Journal of the American Dental Association, Vol. 73, July 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

METHODOLOGY OF EXPOSURE REDUCTION FOR DENTAL AND MEDICAL PRACTICES (Continued)

RH 00350 — IRRADIATION FROM HG-197 AND OTHER RADIOISOTOPE TRACERS

Yen Wang, M.D., D.Sc.(Med.)
Dept. of Radiology
University of Pittsburgh
Pittsburgh, Pennsylvania

Descriptor
Mercury-197 labelled Neohydrin is being evaluated for kidney scans. The injection of unlabelled Neohydrin prior to the injection of the mercury labelled Neohydrin was investigated. Work is proceeding on the correlation between kidney counting and whole-body counting which will enable the quantification of kidney concentration.

Publications
No publications received.

RH 00416 — RADIATION DOSE FROM DIAGNOSTIC ISOTOPE PROCEDURES

Edward M. Smith, Sc.D.
Div. of Nuclear Medicine
Society of Nuclear Medicine
Chicago, Illinois

Descriptor
The objective of this study is to estimate the absorbed dose received by patients from the various radiopharmaceuticals used in nuclear medicine.

Publications
No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

METHODOLOGY OF EXPOSURE REDUCTION FOR DENTAL AND MEDICAL PRACTICES (Continued)

RH 00428 — PHYSICAL AND MEDICAL STUDY CS^{137} SUBSTITUTION FOR RADIUM

Charles G. Amato, B.Sc.
Dept. of Physics
Manhattan College
Bronx, New York

Descriptor
This project is gathering and developing data on Cesium-137 to enable its use as a substitute for radium. Tables are being developed and dosimetry data is being collected and tabulated.

Publications
No publications received.

RH 00431 — RADIATION PROTECTION AND MEASUREMENT

Lauriston S. Taylor, D.Sc.
National Council on Radiation Protection & Measurements
Washington, D. C.

Descriptor
The NCRP is receiving financial support (also from other agencies) from this grant in order to allow it to assess pertinent information on radiation protection. This includes identification of areas where more information is needed, the synthesis of present knowledge and the practical recommendations, etc.

Publications
National Council on Radiation Protection and Measurements. "Radiation Protection in Educational Institutions". NCRP Report No. 32, July 1, 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

METHODOLOGY OF EXPOSURE REDUCTION FOR DENTAL AND MEDICAL PRACTICES (Continued)

RH 00443 PRECISION DOSIMETRY IN CLINICAL RADIOLOGY

John Hale, Ph.D.
Dept. of Radiology
University of Pennsylvania
Philadelphia, Pennsylvania

Descriptor
This study will apply the concept of radiation transfer function to evaluation of cinefluorographic systems used with or without grids in the spot film device. They will continue the study of optimum treatment planning for the 6 MV linear accelerator.

Publications
Bloch, P. "Instrument for Routinely Measuring the Efficiency of a Fluoroscopic Screen." Abstract, Bulletin of the American Physical Society Series 11, Vol. 12, No. 5, p. 643, 1967.

George, D. L. and Wright, D. J. "Single-Field Weighting of Arc-Rotation Techniques." Abstract, Radiology, Vol. 88, No. 1, p. 152, January 1967 and paper presented at the Fifty-second Annual Meeting of the Radiological Society of North America, Chicago, Illinois, Nov. 27-Dec. 6, 1966.

Bloch, P. and Hale, J. "Calibration of Potential of X-Ray Generators in the Diagnostic Energy Region." Physics in Medicine and Biology, Vol. 11, No. 4, p. 577, October 1966.

DEVELOPMENT OF DOSIMETRY, INSTRUMENTATION AND SYSTEMS

RH 00085* DOSE DISTRIBUTIONS IN DIAGNOSTIC X-RAY PROCEDURES

Russell H. Morgan, M.D.
Dept. of Radiological Science
Johns Hopkins University
Baltimore, Maryland

Descriptor
This investigation yielded a comprehensive measure of the dose distributions of the radiation delivered to patients in diagnostic X-ray practices. The data will be

GRANT NO. TITLE OF PROJECT AND PUBLICATIONS

PRINCIPAL INVESTIGATOR AND LOCATION

DEVELOPMENT OF DOSIMETRY, INSTRUMENTATION AND SYSTEMS (Continued)

RH 00085* Descriptor (Continued)
expressed as a function of patient physical and technical parameters and will be in such a form that they may be applied directly to well-controlled epidemiological studies of medical X-ray practices.

Publications
Morgan, R. H. "The Measurement of Radiant Energy Levels in Diagnostic Roentgenology." Radiology, Vol. 76, No. 6, June 1961.

Morgan, R. H. "Progress Toward a Comprehensive Program in Radiation Safety." American Journal of Roentgenology, Radium Therapy and Nuclear Medicine, Vol. 79, No. 2, February 1958.

RH 00283* ACCURACY OF ASSAY BY BODY COUNTERS OF CS^{137} IN MAN

Alexander P. Remenchik, M.D.
Dept. of Medicine
Loyola University
Hines, Illinois

Descriptor
This project was designed to evaluate the effect of body configuration and composition upon the accuracy of the assay of Cesium-137 in a crystal scintillation wholebody counter. Clinically healthy subjects were assayed for their gamma activity.

Publications
Remenchik, A. P., Hukkoo, R. K. and Miller, C. E. "Determination of Body Composition by Gamma Spectrometry." Developments in Applied Spectroscopy, Vol. 5, 1966.

Remenchik, A. P. and Miller, C. E. "Whole-Body Counters." Journal of the American Medical Association, Vol. 197, July 4, 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

DEVELOPMENT OF DOSIMETRY, INSTRUMENTATION AND SYSTEMS (Continued)

RH 00283*

Publications (Continued)

Hukkoo, R. K. and Miller, C. E. "Some Problems of Accurate Measurement of Potassium in Man." Health Division Gamma-Ray Spectroscopy Group Semi-Annual Report, January thru June 1964, ANL-6839, January 1965.

RH 00366 — ENVIRONMENTAL RADIOACTIVITY

Richard I. Weller, Ph.D.
Dept. of Physics
Franklin and Marshall College
Lancaster, Pennsylvania

Descriptor

This research program is developing instrumentation useful in measuring natural environmental radioactivity. The apparatus should be of value in differentiating the separate components of radioactivity and to make possible a better assessment of low level and long term radiation dosages to the public.

Publications

No additional publications received.

RH 00404 — DIGITAL COMPUTING TECHNIQUES IN RADIOLOGICAL PROBLEMS

John L. Howarth, Ph.D.
Dept. of Physics & Astronomy
University of New Mexico
Albuquerque, New Mexico

Descriptor

Theoretical studies of dose distribution near boundaries in inhomogeneous absorbers and the construction of mathematical models for the growth and metastasis of treated and untreated tumors is being performed. Computer techniques are being utilized.

Publications

No additional publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

DEVELOPMENT OF DOSIMETRY, INSTRUMENTATION AND SYSTEMS (Continued)

RH 00470 — COULTER COUNTER ASSAY OF BONE MARROW RADIATION INJURY

Hun Lee, M.A.
Dept. of Surgery
Institute of Medical Sciences
San Francisco, California

Descriptor
This research will develop a technique easily automated for the large scale use of the Coulter Counter for the evaluation of radiation injury of bone marrow. The technique would be valuable in the case of an extensive nuclear accident or nuclear incident.

Publications
No publications received.

STUDIES OF NUCLEAR PLANT MONITORING AND SURVEILLANCE

RH 00077* — EFFECTS OF RADIUM ON STREAM BIOTA BELOW URANIUM MILLS

William F. Sigler, Ph.D.
Dept. of Wildlife Resources
Utah State University
Logan, Utah

Descriptor
Major emphasis was placed on field collections in the area of radium contamination. Various ecological factors and physical parameters were measured. Studies were conducted in areas above and below a newly opened uranium processing mill to study the early pollution effects of mill wastes. Laboratory studies were made to determine uptake of radium by algae. Collection of channel catfish was performed at various points on the Dolores River below Uravan, Colorado, in an effort to assess the degree and frequency of intense pollution.

Publications
Sigler, W. F., Helm, W. T., Angelovic, J. W., Linn, D. W. and Martin, S. S. "The Effects of Uranium Mill Wastes on Stream Biota." Utah Agricultural Experiment Station, Utah State University, Logan, Utah, Bulletin 462, December 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF NUCLEAR PLANT DESIGN CHARACTERISTICS

RH 00412 — ECOLOGY OF RADIONUCLIDES FROM A REPROCESSING PLANT

N. Irving Sax, B. S.
Health Research, Inc.
Albany, New York

Descriptor
Intensive study of the physical characteristics of the aerosols given off by nuclear fuels processing plants (which serves as a point source) is being studied. Surveillance equipment, surveillance methods, ecological surveys and the effect of radioactivity on the environment are all being intensively studied.

Publications
No publications received.

STUDIES OF ENVIRONMENTAL PATHWAYS

RH 00030 — ENVIRONMENTAL EFFECTS ON THE CONTENT OF CS-137 IN MILK

Robert C. Pendleton, Ph.D.
Dept. of Molecular & Genetic Biology
University of Utah
Salt Lake City, Utah

Descriptor
The major environmental factors influencing the accumulation of Cs-137 in milk is being investigated with respect to farming practices, altitude and rainfall, effects of soils, plant complexes, etc. Consuming milk and the Cs-137 in the milk with its effect on human ecology is measured by whole-body counting.

Publications
Pendleton, R. C. and Mays, C. W. "Variability in Levels of Cesium^{137} in Milk from 55 Dairy Farms - Utah 1962-1965." (In manuscript) Read at the Second National Symposium on Radioecology.

Mays, C. W., Zundel, W. S., Lloyd, R. D., Wagner, W. W. and Pendleton, R. C. "Short Half-Times of ^{137}Cs in Pregnant Women." Research in Radiobiology, University of Utah Report COO-119-235, September 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF ENVIRONMENTAL PATHWAYS

RH 00030 Publications (Continued)

Gvosdetzky, V. M. and Pendleton, R. C. "Distribution and Movement of Strontium-90 in Soils of Utah Dairy Farms - 1962-1966." (In manuscript) Read at the Second National Symposium on Radioecology.

Wagner, W. W., Mays, C. W., Lloyd, R. D., Pendleton, R. C. and Zundel, W. S. "Potassium Studies in Humans." Research in Radiobiology, University of Utah Report COO-119-235, September 1966.

Lloyd, R. D., Zundel, W. S., Mays, C. W., Wagner, W. W., Pendleton, R. C. and Aamodt, R. Z. "^{137}Cs Half-times in Normal, in Dystrophic, and in Pregnant Humans." Research in Radiobiology, University of Utah Report COO-119-234, March 1966.

RH 00117* RADIONUCLIDES WITHIN NATURAL ECOSYSTEMS IN GEORGIA

Gayther L. Plummer, Ph.D.
Dept. of Botany
University of Georgia
Athens, Georgia

Descriptor

Ecological investigations were designed to evaluate biogeochemical aspects of natural and fallout radionuclides in selected watersheds. The study covered radioactivity in plants, animals, rates of assimilation, as well as rates of decomposition and the general fate of select radioisotopes in ecological systems.

Publications

Pullen, T. M., Jr., Plummer, G. L. and Provost, E. E. "^{90}Strontium, ^{137}Cesium, and Other Fallout Radionuclides in the Food Chain of a White Tailed Deer Population in the Georgia Piedmont." Bulletin of the Georgia Academy of Science, No. 1, Vol. XXV, January 1967.

Skeen, J. N. and Plummer, G. L. "Morphological Heterogeneity in Andropogon Growing on Areas of High and Low Natural Background Radioactivity." Bulletin of the Georgia Academy of Science, Vol. XXIV, Nos. 2 & 3, September 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF ENVIRONMENTAL PATHWAYS (Continued)

RH 00175 RADIONUCLIDES IN FLORIDA MILK

Edwin G. Williams, M.D.
Florida State Board of Health
Jacksonville, Florida

Descriptor
Research on determining the reasons for the unusual levels of nuclides in Florida milk as influenced by farming practices, geographic location, and the inverse relationship of Sr-90 to Cs-137 is being investigated.

Publications
No publications received.

RH 00215* ACCUMULATION AND RETENTION OF RADIONUCLIDES BY TUBIFEX

Clarence J. Goodnight, Ph.D.
Dept. of Biological Sciences
Purdue University
Lafayette, Indiana

Descriptor
The purpose of this study was to investigate the concentration and retention of radionuclides by the sludge worm tubifex. Under controlled conditions the uptake of P^{32}, Si^{31}, Cu^{64} and Sr^{90} was used at various concentrations. Different stream bottom materials were used for the substrate.

Publications
Whitten, B. K. and Goodnight, C. J. "Toxicity of Some Common Insecticides to Tubificids." Journal Water Pollution Control Federation, Part 1, Vol. 38, No. 2, February 1966.

Whitten, B. K. and Goodnight, C. J. "The Comparative Chemical Composition of Two Aquatic Oligochaetes." Comparative Biochemistry and Physiology, Vol. 17, 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF ENVIRONMENTAL PATHWAYS (Continued)

RH 00307 — BIOLOGICAL CHAINS OF RADIONUCLIDES IN FINNISH LAKES

Jorma K. Miettinen, Ph.D.
Dept. of Radiochemistry
University of Helsinki
Helsinki, Finland

Descriptor

The research is to elucidate the limnological and other factors which effect the enrichment of radionuclides in organisms of the fresh waters, especially the fish. Large scale isotope experiments will take place in which the whole lake or several lakes will be experimentally polluted to get the total balance of the isotope in question in the biota of lakes of different types.

Publications

Kolehmainen, S., Hasanen, E. and Miettinen, J. K. "^{137}Cs in Fish, Plankton and Plants in Finnish Lakes during 1964-65." Radioecological Concentration Processes, Pergamon Press 1967.

Hasanen, E., Kolehmainen, S. and Miettinen, J. K. "Biological Half-Time of ^{137}Cs in Three Species of Fresh-water Fish: Perch, Roach and Rainbow Trout." Radioecological Concentration Processes, Pergamon Press 1967.

Kolehmainen, S., Takatalo, S. and Miettinen, J. K. "A Pollution Experiment with I-131 in an Oligotrophic Lake." Paper presented at the Second National Symposium on Radioecology, Ann Arbor, Michigan, May 15-17, 1967.

Kolehmainen, S., Hasanen, E. and Miettinen, J. K. "^{137}Cs Levels in Fish of Different Limnological Types of Lakes in Finland During 1963." Health Physics, Vol. 12, 1966.

Kolehmainen, S., Hasanen, E. and Miettinen, J. K. "^{137}Cs in the Plants, Plankton, and Fish of the Finnish Lakes and Factors Affecting its Accumulation." Paper submitted at the First International Congress of the International Radiation Protection Association, Rome, Sept. 5-10, 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF ENVIRONMENTAL PATHWAYS (Continued)

RH 00307 Publications (Continued)

Hasanen, E., Kolehmainen, S. and Miettinen, J. K. "Biological Half-Times of ^{137}Cs and ^{22}Na in Different Fish Species and Their Temperature Dependence." Paper submitted for presentation at the First International Congress of the International Radiation Protection Association, Rome, Sept. 5-10, 1966.

STUDIES OF PROTECTIVE ACTION IN ENVIRONMENTAL CONTAMINATION

RH 00124 FISSION PRODUCT - SOIL ORGANIC MATTER COMPLEXES

Robert H. Miller, Ph.D.
Dept. of Agronomy
Ohio Agricultural Research and Development Center
Wooster, Ohio

Descriptor

Characterization and identification of fission product -- soil organic complexes -- is being studied. Plant uptake of fission products from those complexes and the mechanism is being investigated in detail.

Publications

DeDatta, S. K., Franklin, R. E. and Himes, F. L. "Partial Characterization of Soil Polysaccharide-Strontium 90-Yttrium 90 Complexes." Soil Science, Vol. 103, No. 1, 1967.

DeDatta, S. K., Himes, F. L. and Franklin, R. E. "Partial Characterization of Some Strontium 90 and Yttrium 90 Soil Organic Matter Complexes." Soil Science and Plant Nutrition, Vol. 12, No. 6, November 1966.

Tatsukawa, R. and Franklin, R. E. "Effect of Soil Humic Acids on Uptake of Fission Products by Excised Roots." Soil Science Society of America Proceedings, Vol. 30, No. 4, July-August 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF PROTECTIVE ACTION IN ENVIRONMENTAL CONTAMINATION (Continued)

RH 00211 — ALTERED METABOLISM STUDIES OF I-131 AND SR-90

John E. Christian, Ph.D.
Dept. of Bionucleonics
Purdue University
Lafayette, Indiana

Descriptor
The primary objective of this proposed research is to study basic mechanisms by which, (1) the absorption and utilization of the radionuclides Sr-90 and I-131 may be diminished, (2) the rate of elimination may be increased, and/or (3) the route of elimination may be altered with specific references to the development of practical means of preventing or lessening the contamination of the milk supply.

Publications
Barth, K. M., Kessler, W. V., Plumlee, M. P. and Christian, J. E. "Effect of Several Levels of Carrier Iodine on I-131 Retention by Calves." Journal of Animal Science, Vol. 26, No. 3, May 1967.

RH 00322 — SORPTION OF HEAVY METAL RADIONUCLIDES BY MINERALS

Julian B. Andelman, Ph.D.
Public Health Practice
University of Pittsburgh
Pittsburgh, Pennsylvania

Descriptor
This investigation studies the sorption of plutonium on mineral surfaces, the affect of pH ionic strength, nature of ions in solution, temperature, etc.

Publications
No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF PROTECTIVE ACTION IN ENVIRONMENTAL CONTAMINATION (Continued)

RH 00447 — WATER METABOLISM OF CATTLE ON A SEMI-ARID RANGE

Howard H. Weeth, Ph.D.
Animal Science Division
University of Nevada
Reno, Nevada

Descriptor
This study is related to the practical problem of obtaining maximum safe utilization of range forage. Additionally, the observation will aid in interpretation of radioactive fallout data where grazing cattle are used as fallout monitors. Work will be conducted at the Nevada Test Site.

Publications
No publications received.

STUDIES OF POPULATION EXPOSURE

RH 00039 — FOLLOW-UP STUDY OF PATIENTS WHO RECEIVED THOROTRAST AND CONTROL GROUP

Jorge da Silva Horta, M.D.
Instituto de Anatomia Patologica
Faculdade de Medicina
Lisboa, Portugal

Descriptor
Two thousand people received Thorotrast (mainly systemically); 47% of these patients have been traced and the effect of the internal radiation with regard to the overall health has been systematically examined. Controls are not available but the incidence of various debilitating ailments in those receiving Thorotrast versus the general population incidence is analyzed.

Publications
No additional publications.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF POPULATION EXPOSURE (Continued)

RH 00112* TO STUDY RADIOACTIVE NUCLIDES IN TEETH AND BONE

Harold L. Rosenthal, Ph.D.
Dept. of Physiological Chemistry
Washington University
St. Louis, Missouri

Descriptor

This project was designed to analyze the strontium-90 content in deciduous and permanent teeth and bone. Data obtained from children born between 1950 and 1958, a period encompassing Sr-90 increases in milk and food stuffs, demonstrated a linear relationship between tooth Sr-90 and diet Sr-90. Data for human fetuses born between 1961 and 1966, and for permanent bicuspids of children born between 1949 and 1956 are also linear but the slopes of the equations vary. The analyses accounted for the various types and conditions and the year of child birth. From the analyses of this data, relationships were arrived at that yielded necessary information for understanding the metabolism of alkaline earth elements and calcification.

Publications

Rosenthal, H. L., Bird, J. J., Gilster, J. E., Pinto, P. V. C. and O'Neill, S. "Strontium-90 Content of Deciduous Teeth of Children." Journal of Dental Research, Vol. 45, No. 2, March-April 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF POPULATION EXPOSURE (Continued)

RH 00207* ANALYSIS OF CHILDREN RADIATED EARLY IN FETAL LIFE

Melvin Griem, M.D.
Dept. of Radiology
University of Chicago
Chicago, Illinois

Descriptor
This research studies the effect on children of irradiation received in early fetal life. Morbidity and mortality in this irradiated group is being compared with primipara presenting themselves at the hospital before and after the period in which the prenatal x-ray was utilized.

Publications
Griem, M. L., Meier, P. and Dobben, G. D. "Analysis of the Morbidity and Mortality of Children Irradiated in Fetal Life." Radiology, February 1967.

RH 00210 NEOPLASMS IN CHILDREN TREATED WITH X-RAYS

Louis H. Hempelmann, M.D.
Dept. of Radiology
University of Rochester
Rochester, New York

Descriptor
The tumor incidence in two series of youthful populations treated with x-ray in infancy or childhood for benign thyroid conditions is being studied. Chromosomal studies of the neoplastic thyroid nodules will be investigated in detail. A second study on the recipients of blood from donors who subsequently developed leukemia will be traced.

Publications
Hempelmann, L. H. "Radiation-Induced Thyroid Neoplasms in Man." Report presented at Symposium on Thyroid Neoplasia Imperial Cancer Research Fund, April 13-15, 1967.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF POPULATION EXPOSURE (Continued)

RH 00210

Publications (Continued)

Hempelmann, L. H., Pifer, J. W., Burke, G. J., Terry, R. and Ames, W. R. "Neoplasms in Persons Treated with X-Rays in Infancy for Thymic Enlargement. A Report of the Third Follow-up Survey." Journal of the National Cancer Institute, Vol. 38, No. 3, March 1967.

Hazen, R. W., Pifer, J. W., Toyooka, E. T., Livingood, J. and Hempelmann, L. H. "Neoplasms Following Irradiation of the Head." Cancer Research, 26, Part 1, February 1966.

Bakemeier, R. F. and Hempelmann, L. H. "Immunologic Studies in Patients Irradiated for Thymic Enlargement in Early Childhood." Clinical Research, 13, 1965.

RH 00252 — SR-90 IN DECIDUOUS TEETH IN THE GULF COAST AREA

Anthony DiMaggio, Ph.D.
Dept. of Chemistry
Loyola University
New Orleans, Louisiana

Descriptor

This is an epidemiological survey utilizing deciduous teeth from children in the Gulf Coast area. Data on Sr-90 contained in deciduous teeth is compiled with the parameters of tooth type, diet of the children, year of birth and place of birth.

Publications

No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF POPULATION EXPOSURE (Continued)

RH 00260* LEVEL OF DENTAL RADIATION HYGIENE IN COMMUNITY

Leonard F. Menczer, D.D.S., M.P.H.
Hartford Health Department
Hartford, Connecticut

Descriptor
This project evaluated the success of a program of modifications to dental x-ray machines and procedures. Some of the modifications were replacement of plastic pointer cones witn a leaded open-end cone, improved darkroom facilities, replacement of mechanical timers with electronic timers and other procedures whereby the radiation dose was reduced without sacrifice to the image.

Publications
Menczer, L. F. "The Open-ended Metal Column for the Dental X-Ray Machine." Journal of the American Dental Association, Vol. 73, November 1966.

RH 00298 FOLLOW-UP STUDY OF IRRADIATED TINEA CAPITIS CASES

Roy E. Albert, M.D.
Institute of Environmental Medicine
New York Univ. Medical Center
New York, New York

Descriptor
This is a survey of children treated for tinea capitis by x-irradiation to the scalp. The relationship of radiation to cancer and leukemia as well as mental disorders and retardation is being evaluated.

Publications
No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF POPULATION EXPOSURE (Continued)

RH 00316 — NATURAL RADIOACTIVITY IN HUMANS AND THEIR ENVIRONMENT

Masahika Ohira, M.D.
Dept. of Hygiene
Okayama University Medical School
Okayama City, Japan

Descriptor
Research is being conducted in developing reliable methods for the determination of radium, polonium-210 and uranium in water and biological samples. Investigations are being conducted on the distribution of these radionuclides in drinking water, food stuffs and human specimens from populations of several villages where high radioactive hot springs exist as well as controlled areas.

Publications
No publications received.

RH 00461 — TO COLLECT AND STUDY RADIOACTIVE NUCLIDES IN TEETH AND BONE

Harold L. Rosenthal, Ph.D.
Dept. of Physiological Chemistry
Washington University
St. Louis, Missouri

Descriptor
The purpose of this grant is to permit the continual collection of deciduous teeth necessary for the satisfactory culmination of the study to determine the extent of Sr-90 accumulation in teeth as described for Grant RH 00112.

Publications
See Grant No. RH 00112.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF POPULATION EXPOSURE (Continued)

RH 00494 — LATE EFFECTS OF THORIUM DIOXIDE RETENTION IN HUMANS

Murray L. Janower, M.D.
Dept. of Radiology
Massachusetts General Hospital
Boston, Massachusetts

Descriptor
This research effort will study a large group of patients who received thorotrast and an appropriately selected control group at two hospitals in Boston. The effects on humans of low level radiation resulting from this internal emitter shall be studied.

Publications
No publications received.

HUMAN EPIDEMIOLOGY STUDIES

RH 00303 — PRENATAL EXPOSURE TO RADIOACTIVE IRON AFTER 15 YEARS

Robert M. Heyssel, M.D.
Dept. of Medicine
Vanderbilt University
Nashville, Tennessee

Descriptor
This study investigates the effect of the ingestion of radioactive iron by 832 pregnant women. Fifteen years after the ingestion the research assesses mortality, causes of mortality, morbidity in the group and the incidence of congenital malfunction in the offspring of this group. Comparison will be made between the radiation exposed group, the non-exposed group, and siblings of the exposed group.

Publications
No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION
RADIATION BIO-EFFECTS		
RH 00001*	PHYSIOLOGICAL REACTION OF THE AVIAN EMBRYO TO X-RAYS	Robert Moreng, Ph.D. Dept. of Poultry Colorado State University Fort Collins, Colorado

Descriptor

This research covered the modification of metabolic rate, both through increases and decreases in function, on the sensitivity of the avian embryo to x-ray irradiation. The procedure followed was in accordance with the theory that a lowered rate of metabolism in the body, as well as in the tissue, may afford protective action to the irradiated embryo. Low temperatures, addition of vitamin C and genetic background of the dame was investigated for its effect on protective action.

Publications

Muller, H. D. and Moreng, R. E. "Genetic Transmission of Radiation-Induced Physiological Depression in the Domestic Fowl." Radiation Research, Vol. 29, No. 1, September 1966.

Muller, H. D. and Moreng, R. E. "Growth & Reproductive Potential of the Domestic Fowl After Embryonic X-Radiation." Poultry Science, Vol. XLV, No. 2, March 1966.

Moreng, R. E. and Muller, H. D. "Response of the Domestic Fowl to Embryonic X-Irradiation." XIIth World's Poultry Congress Section Papers, 1962.

Moreng, R. E. and Muller, H. D. "Growth and Fecundity of Chickens Irradiated During Embryonic Development." Radiation Research, Vol. 16, No. 4, April 1962.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00021 — THE EFFECTS OF X-IRRADIATION ON THE SMALL INTESTINE

James W. Osborne, Ph.D.
Radiation Research Laboratory
University of Iowa
Iowa City, Iowa

Descriptor

This research determined the physical and biological factors that influenced the occurrence and subsequent growth of radiation-induced intestinal adenocarcinoma and similar lesions in rats.

Publications

Osborne, J. W., Zimmerman, G. R. and Prasad, K. N. "Production in Rats of a Lesion Resembling Intestinal Adenocarcinoma." Abstract: Third International Congress of Radiation Research, Cortina, Italy, June 26-July 2, 1966.

RH 00065 — IONIZING RADIATION, BEHAVIORAL DEVELOPMENT, AND AGING

Ernest Furchtgott, Ph.D.
Dept. of Psychology
University of Tennessee
Knoxville, Tennessee

Descriptor

The aim of this research was to determine the effects of ionizing radiation, administered during the developmental period, on the behavior throughout the organism's life-span. Behavior indices of the irradiated animals were measured versus control animals. Multivariate statistical analysis was employed which would lead to models describing the organization of behavioral development.

Publications

Furchtgott, E. and Black, R. W. "Psychophysiological Arousal in the Albino Rat as a Function of Age and X-Irradiation." Abstract 62, Excerpta Medica, Sixth International Congress of Gerontology, Copenhagen, Denmark.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00065

Publications (Continued)

Furchtgott, E. and Kimbrell, G. McA. "Olfactory Discrimination in Prenatally X-Irradiated Rats." Radiation Research, Vol. 30, No. 2, February 1967.

RH 00081

BASIC MECHANISMS IN THE INDUCTION OF CONGENITAL RADIATION CATARACTS

Roberts Rugh, M.A., Ph.D.
Dept. of Radiology
Columbia University
New York, New York

Descriptor

100R X-ray is used in irradiating mice at early stages of development in order to determine the threshold of cataractogenesis. The exact condition of the zygote and the contribution of either sperm or ovum are also part of this study.

Publications

Rugh, R., Duhamel, L., Somogyi, C., Chandler, A., Cooper, W. R., Smith, R. and Stanford, G. "Sequelae of the LD/50 X-Ray Exposure of the Pre-Implantation Mouse Embryo: Days 0.0 to 5.0." Biological Bulletin, Vol. 131, No. 1, August 1966.

Rugh, R. and Wohlfromm, M. "Previous Reproductive History and the Susceptibility to X-Ray-Induced Congenital Anomalies." Nature, Vol. 210, No. 5039, May 28, 1966.

Rugh, R. and Wohlfromm, M. "Resistance of the Prenatal Female Mouse to X-Ray Sterilization." Fertility and Sterility, Vol. 17, No. 3, May-June 1966.

Rugh, R., Duhamel, L. and Skaredoff, L. "Relation of Embryonic and Fetal X-Irradiation to Life Time Average Weights and Tumor Incidence in Mice." Proceedings of the Society for Experimental Biology and Medicine, Vol. 121, 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00081

Publications (Continued)

Rugh, R., Duhamel, L., Skaredoff, L. and Somogyi, C. "Gross Sequelae of Fetal X-Irradiation of the Monkey (Macaca Mulatta), I. Effect on Body and Organ Weights at 23 Months." Atompraxis 12, Heft 9, 1966.

Rugh, R., Duhamel, L., Skaredoff, L. and Somogyi, C. "Gross Sequelae of Fetal X-Irradiation of the Monkey (Macaca Mulatta), II. Functional Effects Revealed by EEG, ERG, EKG Recordings." Atompraxis 12, Heft 10, 1966.

Rugh, R. and Wohlfromm, M. "Prenatal X-Irradiation and Postnatal Mortality." Radiation Research, Vol. 26, No. 4, December 1965.

Rugh, R. and Skaredoff, L. "Radiation and Radiomimetric Chlorambucil and the Fetal Regina." Archives of Ophthalmology, Vol. 74, September 1965.

Rugh, R. "Definition and Limits of the Concept of Small Dose of Ionizing Radiations, (With Special Reference to Irradiation of Embryo and Fetus)." XI International Congress of Radiology, Rome, Italy, September 22-28, 1965.

Rugh, R. "Neuropathological Sequelae of Fetal X-Irradiation." Abstract, V International Congress of Neuropathology, Zurich, Switzerland, August 30-September 3, 1965.

Rugh, R. and Fu, K. "AET as a Radioprotective Agent at the Cellular Level." Biological Bulletin, Vol. 128, No. 1, February 1965.

Ozzello, L. and Rugh, R. "Acute Pathologic Alterations in X-Irradiated Primate Fetuses." American Journal of Roentgenology, Radium Therapy and Nuclear Medicine, Vol. XCIII, No. 1, January 1965.

Rugh, R. "Ionizing Radiations and Reproductive Capacity." Proceedings of an International Symposium on the Effects of Ionizing Radiation on the Reproductive System, Colorado, 1962.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00097* FERTILITY OF THE MAMMAL (MOUSE) SURVIVING AN EMBRYONIC LD/50/30 EXPOSURE TO X-RAYS

Roberts Rugh, M.A., Ph.D.
Dept. of Radiology
Columbia University
New York, New York

Descriptor
The gonads become highly radiosensitive at some time during the embryonic development. This research analyzed different phenomena by obtaining information on the normal embryonic development of the gonads in mice and by studying the effects of various radiation doses applied at various times before and after delivery. Fertility of the adult, as well as early and late morphological changes, were utilized as criteria. Another adjunct study investigated the difference in the reproductive potential of the virgin female as opposed to the multiparous female and the young versus the old virgin mice, with and without irradiation insult.

Publications
Rugh, R. "Ionizing Radiations and the Mammalian Embryo." Acta Radiologica, Vol. 1, Fasc. 2, April 1963.

RH 00140 PROTECTION AGAINST RADIATION DAMAGE TO CHROMOSOMES

Sidney Mittler, Ph.D.
Dept. of Biological Sciences
Northern Illinois University
DeKalb, Illinois

Descriptor
The repair of injured chromosomes and the indirect mechanism of radiation injury is being studied. ATP is being utilized as well as post treatment by anoxia. The work is being conducted in Drosophila.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00140 (Continued)

Publications

Mittler, S. and Walsh, M. M. "Effect of ATP Upon Radiation Induced Chromosomal Aberrations in Drosophila." Genetics 56:577-8, 1967.

Mittler, S., Arnesen, J. F. and Raymond, U. "Effect of Urethane and Colchicine on Radiation-Induced Chromosome Loss in Male Drosophila." International Journal of Radiological Biology, Vol. 11, No. 2, 1966.

RH 00218

β-IRRADIATION EFFECTS ON DERMAL VASCULAR PERMEABILITY

Joseph Tabachnick, Ph.D.
Laboratory of Experimental Dermatology
Albert Einstein Med. Center
Philadelphia, Pennsylvania

Descriptor

Studies are being made on the permeability of beta-irradiated skin and the late changes that occur. The effect of drug therapy before or after irradiation and the mechanism is being studied.

Publications

Tabachnick, J. and Perlish, J. "Studies on the Biochemistry of Epidermis. III. Content and Some Characteristics of 5'-Nucleotidases, Pyrophosphatases and Phosphomonoesterases of Albino Guinea Pig and Rat Epidermis." The Journal of Investigative Dermatology, Vol. 48, No. 6, 1967.

Tabachnick, J., Song, C. W., Freed, R. M. and Perlish, J. S. "Increased Hydrolase Activity in Beta-Irradiated Epidermis and its Relation to Cell Death." Journal of Albert Einstein Medical Center, Vol. 15, No. 1, January 1967.

Anderson, R. S., Tabachnick, J. and Song, C. W. "Distribution of Label in Guinea Pig Hair and Skin Following I^{125}-Albumin Administration." Dermatologica 134, 1967.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00218

Publications (Continued)

Tabachnick, J., Perlish, J. S. and Chang, L. F. "Epidermal 5'-Nucleotidase Changes in Radiodermatitis." Fed. Proc. 26, p. 429, Abstract #974, 1967.

Tabachnick, J., Perlish, J. S. and Chang, L. F. "Attempts to Demonstrate the Release of Lysosomal Enzymes in Epidermis." Fed. Proc. 25, p. 424, 1966.

Tabachnick, J., Perlish, J. S., Freed, R. M. and Chang, L. F. "Increased Epidermal Deoxyribonuclease I Activity After Clipping or Plucking of Hair and During Wound Healing." Journal of Investigative Dermatology, Vol. 46, No. 6, 1966.

Tabachnick, J., Perlish, J. S. and Freed, R. H. "Studies on the Mechanism for Increased Extracellular Epidermal DNase I Activity in Beta-Irradiated Guinea Pig Skin." Third International Congress of Radiation Research, Cortina D'Ampezzo, June 26 - July 2, 1966.

Song, C. W., Drescher, J. J. and Tabachnick, J. "Suppression of Radiation-Induced Increased Cutaneous Vascular Permeability by Various Anti-Inflammatory Agents." Third International Congress of Radiation Research, Cortina D'Ampezzo, June 26 - July 2, 1966.

RH 00221*

PHOTOENZYMATIC REPAIR OF RADIATION-DAMAGED NUCLEIC ACID

Claud S. Rupert, Ph.D.
Dept. of Biochemistry
Johns Hopkins University
Baltimore, Maryland

Descriptor

The detailed process underlying photoenzymatic repair of ultraviolet inactivated bacterial or viral deoxyribonucleic acids (DNA) and the relationships of this reaction to the photo-recovery processes observed to occur within intact cells were studied.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00221* (Continued)

Publications

Patrick, M. H. and Rupert, C. S. "The Effects of Host-Cell Reactivation on Assay of U. V.-Irradiated Haemophilus Influenzae Transforming DNA." Photochemistry and Photobiology, Vol. 6, 1967.

RH 00243 — EFFECTS OF C-14 ON CYTOGENETICS

David L. Joftes, Ph.D.
Dept. of Radiobiology
New England Deaconess Hospital
Boston, Massachusetts

Descriptor

The inhalation by mice of controlled concentrations of carbon dioxide, carbon 14 labeled, and its effect on DNA and RNA is being studied. The effect of weak beta irradiation on spermatogenesis will be assessed by cytogenetic analysis.

Publications

Joftes, D. L. "Radiobiologic Factors in Radioiodine-Induced Hypothyroidism." Journal of Nuclear Medicine 8, 333, 1967.

RH 00272 — THE AGE FACTOR IN RADIATION SENSITIVITY OF MAMMALS

Joseph Rotblat, Ph.D.
Dept. of Physics
St. Bartholomew's Hospital Medical College
London, England

Descriptor

The role of age and hypoxia in the sensitivity of animals to ionizing radiation is being studied using several systems. One of the systems being studied is the turnover point for induction of leukemia, lung tumors and ovarian tumors in mice. Irradiation under oxygenated or hypoxia conditions as well as single and fractionated doses are being studied.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00272 (Continued)

Publications

Baker, D. J., Lindop, P. J., Morgan, B. W. G., Skeggs, D. B. L., Whittle, R. J. M. and Williams, I. G. "Monitored Regional Hypoxia in Radiotherapy." British Journal of Radiology, Vol. 39, No. 468, December 1966.

Lindop, P. J., Rotblat, J. and Vatistas, S. "The Effect of Age and Hypoxia on the Long-Term Response of the Ovary to Radiation." Radiation & Ageing, December 1966.

RH 00280

EFFECTS OF RADIATION AND DRUGS ON HAIR AND HAIR GROWTH

Frederick D. Malkinson, D.M.D.
Dept. of Medicine/Dermatology
University of Chicago
Chicago, Illinois

Descriptor

These studies in rats and mice will investigate the effect of radiation on hair growth. Chemotherapeutic drugs will be combined with radiation drug therapy to seek further information on factors effecting pharmacologic modifications of radiation responses.

Publications

Griem, M. L. and Malkinson, F. D. "Some Studies on the Effects of Radiation and Radiation Modifiers on Growing Hair." Radiation Research, Vol. 30, No. 2, February 1967.

Malkinson, F. D. and Griem, M. L. "Reduced Growth Rates of Hair in Mice Following Radiation." Archives of Dermatology, Vol. 94, October 1966.

Griem, M. L., and Malkinson, F. D. "Modification of Radiation Response of Tissue by Colchicine." American Journal of Roentgenology, Radium Therapy and Nuclear Medicine, Vol. 97, No. 4, August 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00294 RADIOMIMETIC EFFECTS OF DRUGS AND INSECTICIDES

Karl Sax, Sc.D.
Dept. of Biology
University of Georgia
Athens, Georgia

Descriptor
This research is on radiomimetic agents which are mutagenetic and may be carcinogenic. These agents are tested on seeds and plants.

Publications
Sax, K. and Sax, H. J. "Radiomimetic Beverages, Drugs, and Mutagens." Proceedings of the National Academy of Sciences, Vol. 55, No. 6, June 1966.

RH 00304 CELL DIVISION CYCLE AND RADIOSENSITIVITY. METABOLIC STUDIES.

Valerio Monesi, M.D.
Laboratorio di Radiobiologia Animale
Rome, Italy

Descriptor
This research investigates some fundamental processes underlying cell division and cell differentiation which could be relevant in cell sensitivity to radiation. The research utilizes mice and hamsters; audioradiographic determinations are performed on DNA, RNA and protein synthesis; H^3-thymidine autoradiographic studies of chromosome replication and biochemical characterization of histones in germ cells and embryonic cells from mice are also performed.

Publications
Monesi, V., Crippa, M. and Bignami, R. "The Stage of Chromosome Splitting as Revealed by Irradiation and H^3-Thymidine Experiments." Abstract 625 (1966)

Monesi, V. "Synthetic Activities During Spermatogenesis in the Mouse." Experimental Cell Research 39, 1965.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00306* CYSTEAMINE AND X-RAYS PRENATALLY: BEHAVIOR OF THE RAT

Joan Havlena, Ph.D.
Dept. of Radiology
Wayne State University
Detroit, Michigan

Descriptor

Research was performed on evaluating known chemical radioprotective agents and their usefulness against irradiation in utero and the resultant behavioral alterations. The measures of effectiveness were ability, seizure susceptibility, maturation of motor responses, ch nges in activity level, etc. X-irradiation at 50 to 185R was used.

Publications

Havlena, J. M. "Shock-Avoidance Behavior and Black-White Color Discrimination in Adult Rats Chemically Protected Against Prenatal Irradiation." Paper presented at the Midwestern Psychological Association Meetings, Chicago, Illinois, May 7, 1966.

Havlena, J. M. "The Effects of Chemical Radio-Protector on the Behavior of Rat Offspring." Paper presented at the Midwestern Psychological Association Meetings, Chicago, Illinois, April 30, 1965.

RH 00309* EFFECTS OF IONIZING RADIATION ON MAMMALIAN GAMETES AND ZYGOTES

M. C. Chang, Ph.D.
Worcester Foundation for Experimental Biology, Inc.
Shrewsbury, Massachusetts

Descriptor

The study consisted of: (1) the effects of radiocobalt irradiation of rabbit sperm, eggs or both in vivo and in vitro on the fertilization rate, morphology of pronuclei, the cleavage rate, the blastocyst formation and the probability of normal development; (2) the effects of irradiation of hamster head on their

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00309*

Descriptor (Continued)
reproductive performance; (3) the effect of irradiation of rabbit sperm in the presence of air, oxygen, or nitrogen; (4) the determination of the radiation LD 50 on the family Cricetidae.

Publications

Chang, M. C., Hunt, D. M. and Turbyfill, C. L. "Irradiation of Rabbit Sperm and Eggs In Vivo on Their Subsequent Fertilization and Early Development." Anat. Rec. 151:334, 1966.

Dott, H. M., Ishida, K. and Chang, M. C. "The Effect of X-Irradiation of Rabbit Spermatozoa In Vitro In Different Gases on Egg Development and Sperm Dehydrogenases." Journal of Reprod. Fert., Vol. 11, 1966.

Chang, M. C., Hunt, D. M. and Turbyfill, C. L. "Fertilization and Early Development after Radiocobalt Irradiation of Rabbit Oocytes and Sperm in the Female Tract." The Anatomical Record, Vol. 154, No. 4, April 1966.

Turbyfill, C. L. and Chang, M. C. "Effects of Irradiation on the Plasma Volume and Thiocyanate Space in the Hamster." Fed. Proc. 24:702, 1965.

Turbyfill, C. L. and Marston, J. H. "Radiocobalt Lethality Studies with the Deer Mouse." American Zoologist, Vol. 5, No. 2, May 1965.

Chang, M. C. and Pincus, G. "Fertilizable Life of Rabbit Sperm Deposited into Different Parts of the Female Tract." V Congresso Internazionale Per La Riproduzione Animale E La Fecondazione Artificiale, Trento 6, 13 Settembre 1964.

Chang, M. D., Hunt, D. M. and Turbyfill, C. "High Resistance of Mongolian Gerbils to Irradiation." Nature, Vol. 203, No. 4944, August 1, 1964.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00328 — ANCESTRAL VS DIRECT EFFECTS OF IRRADIATION ON MAMMALS

John W. Gowen, Ph.D.
Dept. of Radiology and Radiation Biology
Fort Collins, Colorado

Descriptor
This research program is directed towards determining the mechanism by which two major environmental hazards to life operate: 1. effect of exposure to radiant energy on mammalian life; and, 2. the interrelations by which hosts control the entry, spread and ultimate lethality of infectious disease.

Publications
No publications received.

RH 00330 — LOW LEVEL GAMMA RADIATION AND PHYSIOLOGICAL PERFORMANCE

George M. Krise, Ph.D.
Radiation Biology Lab.
Texas A&M University
College Station, Texas

Descriptor
Sexually mature Spanish goats, both male and female, were exposed to cobalt 60 gamma radiation at rates of 40, 20, 5, 2, and 0 (control) rads per 20 hour day for 42 months or until death. Radiation damage was evaluated by examining reproductive capacity, physiological performance, peripheral hematology and mortality. Physiological performance was measured by use of obstacle courses where time and motor skills were recorded by clinical and physiological observations. EEG and ECG as well as respiration rate and other factors were measured.

Publications
Leidy, R. B., Austin, J. W. and Hupp, E. W. "Effects of Chronic Gamma Irradiation on the Peripheral Blood of Spanish Goats." Radiation Research 27:531, 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00330

Publications (Continued)

Szabuniewicz, M., McCrady, J. D. and Banknieder, A. R. "Ophthalmodynamometry for Clinical Measurement of Blood Pressure in the Goat." The Southwestern Veterinarian, No. 4, Vol. XIX, Summer 1966.

Leidy, R. B., Austin, J. W. and Hupp, W. W. "Normal Hematological Values of Peripheral Blood in Adult Spanish Goats." The Texas Journal of Science, Vol. XVIII, No. 1, May 20, 1966.

RH 00345 — PROTEIN METABOLISM IN NORMAL AND IRRADIATED LENSES

Morris Green, Ph.D.
Dept. of Biological Sciences
Hunter College
New York, New York

Descriptor

This investigation determined whether alterations in the dysfunction in lens permeability occur as primary factors in the formation of opacity or if they are induced only as a secondary response to irradiation.

Publications

No publications received.

RH 00364 — EEG AND BEHAVIORAL EFFECTS OF GAMMA RADIATIONS

Daniel E. Sheer, Ph.D.
Dept. of Psychology
University of Houston
Houston, Texas

Descriptor

This research is concerned with the investigation of 200, 500, and 800R of gamma radiation, both head only and body only, on the electrical activity of the olfactory bulb, amygdala, and cortex in cats. The impulses will be computer analyzed for auto

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00364

Descriptor (Continued)
and cross-correlation and related to performance in the behavioral situations, both pre- and post-irradiation.

Publications
No publications received.

RH 00390 EFFECTS OF AGING AND RADIATION ON HAARSCHEIBE PIGMENT

P. Donald Forbes, Ph.D.
Dept. of Biology
Barrington College
Barrington, Rhode Island

Descriptor
The effect of radiation on skin pigmentation is being studied in mice.

Publications
No publications received.

RH 00391 AGING IN X-RAY IRRADIATION AND NON-IRRADIATION

Roger T. Davis, Ph.D.
Dept. of Psychology
University of South Dakota
Vermillion, South Dakota

Descriptor
This research investigates the memory patterns, strength and persistence of responses, and vigilance of old irradiated and old control monkeys, and the progeny of the old animals.

Publications
No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00400 — PROLONGED PRIOR TRAINING AND RADIATION RESISTANCE

William W. Heusner, Ph.D.
Dept. of Health, Physical Education & Recreation
Michigan State University
East Lansing, Michigan

Descriptor
The purpose of this investigation was to study the effect of various levels of pre-irradiation physical activity upon the radiation resistance of animals. Rats were used and received 650R of x-irradiation.

Publications
No publications received.

RH 00467 — RADIATION EFFECTS UPON NERVOUS SYSTEM AND BEHAVIOR

John Garcia, Ph.D.
Dept. of Surgery
Massachusetts General Hospital
Boston, Massachusetts

Descriptor
The objective of this research is to study in more detail the mechanism or mechanisms by which radiation acts as an immediate stimulus; to study the mechanisms which produce toxin-like symptoms; to test specific hypothesis relevant to general principles of learning raised by the use of radiation as an aversive (drive) stimulus.

Publications
Garcia, J., Ervin, F. R., Yorke, C. H. and Koelling, R. A. "Conditioning with Delayed Vitamin Injections." Science, Vol. 155, No. 3763, February 10, 1967.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00473 — EFFECT OF IONIZING RADIATION ON CIRCADIAN RHYTHMS

Sherwin Mizell, Ph.D.
Dept. of Anatomy and Physiology
Indiana University
Bloomington, Indiana

Descriptor
This research will test the effect of low level ionizing radiation on the central nervous system by determining whether this radiation stimulus can act as a synchronizer of rhythmic physiological functions.

Publications
No publications received.

RH 00474 (Formerly RH 00197) — RADIATION AND PROTECTION IN ENZYME SYSTEMS

Wolfgang H. Lohmann, D.Sc.
Radiation Research Laboratory
University of Iowa
Iowa City, Iowa

Descriptor
This project investigates the radiation effect on metalloenzymes as well as the modification of these effects by the addition of both inorganic and organic compounds prior to x-irradiation in aqueous enzyme solutions.

Publications
Lohmann, W., Moss, Jr., A. J., Garland, W. B. and Woodall, D. M. "Influence of Serotonin on the Radiation Sensitivity of Lactate Dehydrogenase." Separatum Experientia 22, 514, 1966.

Lohmann, W., Moss, Jr., A. J., and Barker, S. L. "Radioprotective Effect of Dimethylsulfoxide on Lactate Dehydrogenase." Die Naturwissenschaften, Heft 24, S. 702, 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00474 Publications (Continued)

Lohmann, W. and Fowler, C. F. "Photo-Induced Electron Transfer in Dye-dimethylsulfoxide-metal Ion Complexes: Electron Spin Resonance Investigations." Zeitschrift Fur Naturforschung, Band 21a, Heft 7, 1966.

Lohmann, W. and Moss, Jr., A. J. "Modification of the Radiation Effect on Catalase by Selenium." Journal of Nuclear Medicine, 7, November 1966.

Lohmann, W., Moss, Jr., A. J., Sanders, J. L., Porter, B. J. and Woodall, D. M. "Studies on the Molecular Mechanism of the Radioprotective Effect of Serotonin." Radiation Research, Vol. 29, No. 2, October 1966.

RH 00487 CYTOGENETICS OF IRRADIATED MALE MICE

Allen B. Griffen, Ph.D.
The Jackson Laboratory
Bar Harbor, Maine

Descriptor

This project will determine the frequency of induced major chromosome abnormalities in the permanent generative stem cells of mice testis after both single and fractionated specific doses of x-rays.

Publications

No publications received.

RH 00496 EFFECT OF RADIATION ON AMINO ACID TRANSPORT

Ellen G. Archer, Ph.D.
Div. of Nuclear Medicine
Washington University
St. Louis, Missouri

Descriptor

This research deals with irradiating mice bearing Ehrlich's ascites tumors. Cells will be isolated at various times after radiation for investigation of changes in

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION BIO-EFFECTS (Continued)

RH 00496

Descriptor (Continued)
membrane transitory processes and other relationship to the synthesis of nucleic acid and other proteins. Carbon-14 labelled amino acid will be used.

Publications
Archer, E. "Heterogeneity of Amino Acid Transport in Lactobacillus Casei." Fed. Proc. 25, 542, 1966.

MECHANISMS OF RADIATION DAMAGE

RH 00005 — RADIATION EFFECTS ON FORMATION OF PROTEIN AGGREGATES

Herman R. Haymond, Ph.D.
Dept. of Radiology
University of Southern California
Los Angeles, California

Descriptor
This investigation deals with the effects of ionizing radiation on interactions between proteins by a study of the radiation effects on antigen-antibody reactions. Current work is concerned with the effects of radiation on the reaction between insulin and its rabbit serum antibody.

Publications
Haymond, H. R. "Radiation Induced Inactivation of Antiserum to Insulin in Dilute Aqueous Solution." Abstract No. 415, Third International Congress of Radiation Research, Cortina D'Ampezzo, Italy, June 26 - July 2, 1966.

Haymond, H. R. "Effects of X-Irradiation of Aqueous Solutions of Rabbit Antiserum-to-Insulin." Paper presented at the Twelfth Annual Meeting of the Radiation Research Society, Miami Beach, May 18-20, 1964.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00042 COMPOUNDS TO PROMOTE EXCRETION OF RADIOISOTOPES

William Strain, Ph.D.
Dept. of Radiology
University of Rochester
Rochester, New York

Descriptor

Compounds to promote the excretion of radioisotopes are being studied in relation to radionuclides resulting from fallout and atomic power and to radioisotopes used for diagnosis. Increasing the dietary intake of stable forms of the isotope and various chelating agents on the uptake, retention and excretion of the radionuclides are being investigated.

Publications

Pories, W. J., Rob, C. G., Smith, J. L., Henzel, J. H. and Strain, W. H. "The Treatment of Atherosclerosis with Zinc Sulfate." Paper presented at the Military Medicine Section, American Medical Association Convention, Atlantic City, New Jersey, June 18-22, 1967.

Strain, W. H., Rob, C. G., Pories, W. J., Hennessen, J. A., Montoya, J., Barker, W., and Haskins, J. "Nuclear Methods for the Study of Zinc Metabolism." Transactions of the American Nuclear Society, Vol. 10, June 1967.

Pories, W. J., Smith, J. L., Henzel, J. H., Rob, C. G. and Strain, W. H. "Zinc Therapy in Atherosclerosis." Paper presented at the 15th Annual Symposium of the Society of Air Force Clinical Surgeons, Lackland AFB, Texas, May 8-10, 1967.

Pories, W. J., Henzel, J. H., Rob, C. G. and Strain, W. H. "Acceleration of Healing with Zinc Sulfate." Annals of Surgery, Vol. 165, No. 3, March 1967.

Strain, W. H., Danahy, D. T., O'Reilly, R. J., Thomas, M. R., Wilson, R. M. and Pories, W. J. "Promotion of Radioisotope Excretion." Journal of Nuclear Medicine 8, February 1967.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00042

Publications (Continued)

Pories, W. J., Henzel, J. H., Rob, C. G. and Strain, W. H. "Acceleration of Wound Healing in Man with Zinc Sulphate Given by Mouth." The Lancet, January 21, 1967.

Strain, W. H., Steadman, L. T., Lankau, Jr., C. A., Berliner, W. P. and Pories, W. J. "Analysis of Zinc Levels in Hair for the Diagnosis of Zinc Deficiency in Man." The Journal of Laboratory and Clinical Medicine, Vol. 68, No. 2, August 1966.

Strain, W. H. and Pories, W. J. "Zinc Levels of Hair as Tools in Zinc Metabolism." Zinc Metabolism, Chapter 20, 1966.

RH 00095 INACTIVATION OF ENZYMES BY IONIZING RADIATION

Evelyn Slobodian, Ph.D.
Dept. of Radiology
New York Univ. Medical Center
New York, New York

Descriptor

The effects of gamma irradiation on the enzyme Ribonuclease A are investigated. Comparative studies are made to evaluate the role of the various free radicals involved in the aqueous irradiation effect. Significant changes have been noted in the chromatographic behavior, chemical composition and physico-chemical properties of irradiated enzyme. Similar alterations are observed in enzyme samples which have been inactivated by chemically generated hydroxyl radicals.

Publications

Slobodian, E. and Fleisher, M. "Effects of γ-Irradiation on the Structure of Ribonuclease." Biochemistry, 5:2192-2200, 1966.

Slobodian, E., Newman, W., Fleisher, M. and Rubenfeld, S. "Modification of Ribonuclease Structure by Gamma Irradiation." Biochimica et Biophysica Acta, III, 1965.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00095

Publications (Continued)

Slobodian, E., Fleisher, M., Newman, W. and Rubenfeld, S. "Effects of Gamma Radiation on Ribonuclease." Archives of Biochemistry and Biophysics 97, 59-69, 1962.

RH 00098 ENZYMATIC AND ESR STUDIES OF RADIATION DAMAGE

Alexander Pihl, M.D.
Dept. of Biochemistry
Norsk Hydro's Institute
for Cancer
Oslo, Norway

Descriptor

The mechanism of radiation inactivation of proteins and DNA is being studied. Secondary radical reactions which take place are being analyzed using ESR, the effect of various additives and gas pressures is also being investigated. The mechanism of indirect effect in frozen aqueous solutions and survival of irradiated bacteria is beingcontinued.

Publications

Sanner, T. and Pihl, A. "Kinetics of Enzyme Inactivation in Solution by Ionizing Radiation." European Journal of Biochemistry 1, 33-35, 1967.

Copeland, E. S., Sanner, T. and Pihl, A. "Radical Transfer Reactions and Chemical Protection in the Dry State. Electron Spin Resonance Studies on Irradiated Mixtures of Ribonuclease and Glycyl-Glycine." European Journal of Biochemistry 1, 312-316, 1967.

Damjanovich, S., Sanner, T. and Pihl, A. "The Role of the Allosteric Sites in the X-Ray Inactivation of Phosphorylase b." European Journal of Biochemistry 1, 347-352, 1967.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00098

Publications (Continued)

Damjanovich, S., Sanner, T. and Pihl, A. "Preferential Protection of the Regulatory Function of Phosphorylase b against X-Ray Inactivation in Solution." Biochimica et Biophysica Acta, 136, 593-595, 1967.

Sutherland, R. M. and Pihl, A. "Repair of Radiation Damage to Membrane Sulfhydryl Groups of Human Erythrocytes." Biochimica et Biophysica Acta, 135, 568-570, 1967.

Henriksen, T. and Sanner, T. "Radiation-induced Organic Sulfur Radicals at 77°K." Acta Chemica Scandinavica, 20, 2888-2890, 1966.

Sanner, T. and Pihl, A. "Decay of Radiation Induced Radicals and the Yield of Thermoluminescence." Acta Chemica Scandinavica 20, 1966.

Kleppe, K., Sanner, T. and Pihl, A. "Preferential Inactivation of the Allosteric Function of Aspartate Transcarbamylase by X-Rays." Biochimica et Biophysica Acta, 118, 1966.

Henriksen, T. "Production of Free Radicals in Solid Biological Substances by Heavy Ions." Radiation Research, Vol. 27, No. 4, September 1966.

Pihl, A. and Sanner, T. "Radiation Sensitivity of Cells and Base Composition of DNA: An Electron Spin Resonance Study." Radiation Research, Vol. 28, No. 1, May 1966.

Henriksen, R. "Effect of the Irradiation Temperature on the Production of Free Radicals in Solid Biological Compounds Exposed to Various Ionizing Radiations." Radiation Research, Vol. 27, No. 4, April 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00193 MECHANISM OF THIOL PROTECTION AGAINST RADIATION

Walter T. Smith, Jr., Ph.D.
Dept. of Chemistry
University of Kentucky
Lexington, Kentucky

Descriptor
This project will prepare a variety of sulfinamides to be tested for protection against radiation damage. Since thiols protect against radiation by forming disulfides, then sulfinamides can be expected to offer some degree of protection.

Publications
No publications received.

RH 00197* RADIATION AND PROTECTION IN ENZYME SYSTEMS

Wolfgang Lohmann, Ph.D.
Dept. of Physiology
Univ. of Arkansas Medical Center
Little Rock, Arkansas

Descriptor
Studies were performed on the complex formation between radioprotective substances and the many metallo-enzymes resulting in a superior radioprotective effect. The use of DMSO (dimethylsulfoxide) was investigated on a molecular level by the use of optical absorption as well as ESR studies. Selenium-containing compounds due to their similarities in electronic structure to sulfur were also investigated.

Publications
Lohmann, W., Sanders, L., Moss, Jr., A. J. and Porter, J. "Modification of the Radiosensitivity of Catalase by Serotonin." Radiation Research, Vol. 27, No. 3, March 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00222 — STUDIES OF RADIOSTRONTIUM METABOLISM AND REMOVAL IN MAN

Herta Spencer, M.D.
Dept. of Medicine
Loyola University
Chicago, Illinois

Descriptor

Studies of the enhancement of radiostrontium excretion in man will be continued using agents which have been shown to be effective in decreasing the radiostrontium body-burden in experimental animals. These agents will be administered parenterally in order to remove radiostrontium from bone and soft tissue, and orally in order to decrease the absorption of radiostrontium from the intestine. Sodium sulfate, parathyroid hormone, chelating agents and pectins will be used.

Publications

Spencer, H., Lewin, I. and Samachson, J. "Effect of Magnesium on Radiostrontium Excretion in Man." The International Journal of Applied Radiation and Isotopes, Vol. 18, No. 6, June 1967.

Spencer, H., Menczel, J. and Samachson, J. "Effect of Mercuhydrin Alone and in Conjunction with Ammonium Chloride on Radiostrontium Excretion in Man." Proceedings of the Society for Experimental Biology and Medicine, v124, 1110-1116, 1967.

Spencer, H. and Rosoff, B. "Effect of Chelating Agents on the Removal of Zinc-65 in Man." Health Physics, Vol. 12, 1966.

Spencer, H., Lewin, I. and Samachson, J. "Effect of Thyroid and Parathyroid Function on Radiostrontium Absorption." Federation Proceedings, Vol. 25, No. 2, March-April 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00222

Publications (Continued)

Spencer, H. and Rosoff, B. "Removal of Scandium-46 in Man." Health Physics, Vol. 11, 1965.

Spencer, H. and Rosoff, B. "Effects of Chelating Agents in Man." Chelation Therapy, publ. Charles C. Thomas, pp. 34-65, 1964.

RH 00239

RADIATION PROTECTION AND RECOVERY IN GERMFREE ANIMALS

Raphael Wilson, Ph.D.
Dept. of Biology
University of Notre Dame
Notre Dame, Indiana

Descriptor

To assess the contribution of microorganisms to radiation disease, germfree animals are being studied pathologically for protection and recovery after a regime of irradiation. Physiological responses are also being studied as well as the effectiveness and mode of action of protective chemotherapeutic agents. Bone marrow transplantation is also utilized.

Publications

Wilson, R. and Bealmear, P. M. "Radiation Pathology in Germfree Mice and Bone Marrow Transplantation in Irradiated Germfree Mice." Radiation Society of Japan, 1967.

Wilson, R., Ledney, G. D. and Matsuzawa, T. "The Mode of Action of Bacterial Endotoxin as a Radioprotective Agent in Mice Exposed to Lethal Wholebody X-Irradiation." Progr. Biochem. Pharmacol., Vol. 1, 1965.

Wilson, R. "The Pathology of Radiation Disease in Germfree Mice and Treatment with Bone Marrow Transplants." NATO Advanced Study Institute--The Germ-free Animal in Research. Elvetham Hall, Hartley Wintney, Hampshire, England, 1965.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00239

Publications (Continued)

Wilson, R., Matsuzawa, T. and Sr. St. James Connell. "Hematological Changes in Germ-free Mice Following Whole-Body X-Irradiation." Radiation Research 22:249-250, 1964.

Ledney, G. D. and Wilson, R. "Diet and Water Consumption and Body Weight of Germfree Mice Following Wholebody X-Irradiation (750R)." Radiation Research 22: 208, 1964.

Matsuzawa, T. and Wilson, R. "Separation of the Radioprotective Effects of Hypothermia and Hypoxia in Young Mice Exposed to 410R Wholebody X-Irradiation." Radiation Research 22:212-213, 1964.

Wilson, R. "The Use of Germfree Animals in the Study of the Effects of Radiation." Symposium on Recent Advances in Germfree Animal Experimentation 1959-1962.

RH 00245

DEHYDROGENASE KINETICS "UNDER THE BEAM"

G. Hoyt Whipple
Dept. of Environmental Health
University of Michigan
Ann Arbor, Michigan

Descriptor

Several dehydrogenases are being studied during x-irradiation to determine whether the previously observed transient decrease in reaction velocity of NADH oxidase during irradiation is a more general property of dehydrogenases.

Publications

No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00246 — EFFECTS OF RADIATION ON THE MIGRATION OF SALMONIDS

Frank P. Conte, Ph.D.
Radiation Center
Oregon State University
Corvallis, Oregon

Descriptor
This study investigates the molecular and cellular mechanisms involved in the active transport of ions and water across the epithelial membranes. The work is being performed on young salmon with irradiation in the range of greater than 1,000R.

Publications
Conte, F. P., Wagner, H. H., Fessler, J. and Gnose, C. "Development of Osmotic and Ionic Regulation in Juvenile Coho Salmon Oncorhynchus Kitsutch." Comp. Biochem. Physiol., Vol. 18, 1966.

RH 00268 — LOCAL CHEMICAL RADIATION PROTECTION IN MICE

Robert A. Goepp, D.D.S., M.S.
Dept. of Pathology
University of Chicago
Chicago, Illinois

Descriptor
This study will determine if several radioprotective chemicals are of value when they are applied directly to the mucosal surface of the tongue; mice will receive X-irradiation to the head of approximately 2,000R.

Publications
Goepp, R. A., Fitch, F. W. and Doull, J. "The Use of Parenteral Chemicals for Protection Against Oral Radiation Death in Mice." Radiation Research, Vol. 31, No. 1, May 1967.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00268

Publications (Continued)

Goepp, R. A. and Fitch, F. W. "Topical Chemical Protection in Oral Radiation Death in Mice." Paper presented at the Sixty-Fourth Annual Meeting of the American Association of Pathologists and Bacteriologists, March 10, 1967.

Goepp, R. A. and Fitch, F. W. "The Effects of Systemic and Local Chemical Protection on Oral Radiation Death in Mice and on Cell Recovery in Mouse Tongue." Paper presented at the Third International Congress of Radiation Research, Cortina D'Ampezzo, Italy, June 28, 1966.

RH 00279 DISPLACEMENT REACTIONS OF ANTI-RADIATION DRUGS

Robert E. Davis, Ph.D.
Dept. of Chemistry
Purdue University
Lafayette, Indiana

Descriptor

The thesis of this proposal is that the activity of anti-radiation drugs can be correlated with the oxidation potential, the basicity and the degree of "pi" participation of the drug.

Publications

Davis, R. E., Nehring, R., Molnar, S. P. and Suba, L. A. "Displacement Reactions. X. Oxibase Scale Parameters of an Anti-Radiation Drug-MEA." Tetrahedron Letters No. 9, 1966.

Davis, R. E., Nakshibendi, H. and Ohno, A. "Displacement Reactions. XI. The Oxibase Parameters of Thio Anions." Journal of Organic Chemistry, 31, 2702, 1966.

Wagner, E. S. and Davis, R. E. "Displacement Reactions. IX. The Reaction of Cyanide Ion with Cystine. An Example of Amino Group Participation as Detected with Nitrogen-15 During Cleavage of a Sulfur-Sulfur Bond." Journal of the American Chemical Society, 88:1, January 5, 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00279

Publications (Continued)
Davis, R. E., Louis, J. B. and Cohen, A. "Displacement Reactions. VIII. A Correlation Between the Sulfur-Sulfur Bond Distance and the Activation Energy for a Process Breaking the Bond." Journal of the American Chemical Society, 88:1, January 5, 1966.

RH 00293 — α-ALKYLOXIMINOMERCAPTANS FOR PROTECTION IN RADIOTHERAPY

Dominick A. Coviello, Ph.D.
Dept. of Chemistry
University of Illinois
Chicago, Illinois

Descriptor
The main objective of this research is to prepare synthetic chemicals for use as protective agents against ionizing radiation and to obtain information from model compounds to aid in the design of more potent protective agents.

Publications
Coviello, D. A. "Potential Antiradiation Drugs: α-Alkyloximinonitriles" Journal of Pharmaceutical Sciences, Vol. 56, No. 2, February 1967.

RH 00297 — RADIOPROTECTIVE BASIC THIOLS

William O. Foye, Ph.D.
Dept. of Chemistry
Massachusetts College of Pharmacy
Boston, Massachusetts

Descriptor
The research deals with radioprotective agents and the phenomena of metal binding in the biological activities of drugs.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00297 (Continued)

Publications

Foye, W. O., Hebb, A. M., and Mickles, J. "Antiradiation Compounds, VIII. Reaction of Thiols with Cyanogen Bromide." Journal of Pharmaceutical Sciences, Vol. 56, No. 2, February 1967.

Foye, W. O. and Kauffman, J. M. "1,3-Dipolar Cycloaddition of Carbon Disulfide to a Nitril Oxide." Journal of Organic Chemistry, 31, 2417, 1966.

RH 00305 — INACTIVATION OF ENZYMES BY IONIZING RADIATION

George Gorin, Ph.D.
Dept. of Chemistry
Oklahoma State University
Stillwater, Oklahoma

Descriptor

The inactivation of several enzymes by gamma irradiation is being studied. The protective action of some mercaptan and disulfide compounds is also studied with relation to selected enzymes. Irradiation of enzymes in tritiated water and the incorporation of the C-bound tritium will be determined; this has importance in the understanding of the repair mechanism.

Publications

Gorin, G. "Mercaptan-Disulfide Interchange and Radioprotection." Progr. Biochem. Pharmacol., Vol. 1, 1965.

RH 00312 — FACTORS AFFECTING RADIOSENSITIVITY IN MICRO-ORGANISMS

Carl A. Beam, Ph.D.
Dept. of Biology
Brooklyn College
Brooklyn, New York

Descriptor

Radiobiology of yeast cells is being scrutinized at two levels: 1. metabolically related factors affecting the radiosensitivity of inter-divisional cells, and

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MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00312

Descriptor (Continued)
2. the basis, genetic or biochemical, for the high radiation resistance of budding yeast cells.

Publications
No publications received.

RH 00318 — GENESIS OF POSTIRRADIATION HYPERLIPEMIA IN THE RABBIT

Wallace R. Wooles, Ph.D.
Dept. of Pharmacology
Medical College of Virginia
Richmond, Virginia

Descriptor
The study deals with the effect of 1,000R whole-body ionizing radiation upon rabbits and the activity of tissue lipoprotein lipase (LPL) activity in the uptake of 1-C^{14} palmitic acid by the interscapular fat pad of the rabbit.

Publications
Wooles, W. R. "Triglyceride Synthesis Following Whole-Body X-Irradiation in the Rabbit." Radiation Research, Vol. 30, No. 4, April 1967.

RH 00321 — STUDIES IN RADIATION PROTECTION

Robert R. Kuntz, Ph.D.
Dept. of Chemistry
University of Missouri
Columbia, Missouri

Descriptor
This research studies radiation damage to amino acids, peptides, disulfides and thiol compounds of importance to biological systems as well as known chemical protectors and sensitizers.

Publications
No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00324* AMINOTHIONIMIDES AS RADIATION PROTECTIVE AGENTS

Donald T. Witiak, Ph.D.
College of Pharmacy
University of Iowa
Iowa City, Iowa

Descriptor
This research concerns the synthesis and biological evaluation of various radiation protecting substances. Electron spin resonance and other measurements are made to yield information about the in vivo mechanism.

Publications
No additional publications.

RH 00325* DIFFERENTIAL RESISTANCE OF CELLS TO IRRADIATION

Carl C. Speidel, Ph.D.
Dept. of Anatomy
University of Virginia
Charlottesville, Virginia

Descriptor
Irradiation treatment using gamma and ultraviolet rays will be given to sea urchins, gametes and zygotes. Similar treatment will be given with certain radiomimetic compounds especially colchicine and caffeine. Alteration of the DNA molecule will be observed.

Publications
Speidel, C. C. and Cheney, R. H. "Abnormalities in Developing Sea Urchins Induced by Certain Radiomimetic Chemical Compounds Compared with thos Induced by Irradiation, with Special Reference to Nuclear Damage." Biological Bulletin, Vol. 129, No. 2, October 1965.

Speidel, C. C. and Cheney, R. H. "Comparative Deviations in Motility of Developing Sea Urchins Induced by Irradiation." Biological Bulletin, Vol. 127, No. 2, October 1964.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00347 RADIATION EFFECTS OF THYMIDINE-TRITIUM

Henry A. McQuade, Ph.D.
Dept. of Radiology
University of Missouri
Columbia, Missouri

Descriptor
Utilization of uridine-H^3 and thymidine-H^3 in interphase nuclei of allium cepa seedling root tips is studied with autoradiographs in electron and phase microscopy. Autoradiographs are also made from sections heated with RNAse and DNAse.

Publications
No publications received.

RH 00354 METABOLISM OF RADIOSTRONTIUM

Clarence R. Creger, Ph.D.
Dept. of Biochemistry and Nutrition
Texas A&M University
College Station, Texas

Descriptor
The research is to determine the effects of low levels of contamination of parents (rabbits and chicks) with radiostrontium on future F_1, F_2, and F_3 generations. Also, to determine the physiological effects and the effects of various circumstances in accelerating radiostrontium excretion. Work will be done to determine the extent radiostrontium is capable of replacing calcium in various metabolic functions of calcium metabolism.

Publications
Creger, C. R., Colvin, L. B., Couch, J. R. and Ansari, M. N. A. "The Effect of Various Dietary Calcium Levels on the Elimination of Strontium-89." Health Physics, Vol. 13, No. 4, April 1967.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00354

Publications (Continued)

Creger, C. R., Ansari, M. N. A., Colvin, L. B. and Couch, J. R. "Distribution of Calcium and Strontium in the Blood of the Laying Hen." Proceedings of the Society for Experimental Biology and Medicine, Vol. 124, 1967.

Creger, C. R., Ansari, M. N. A., Couch, J. R. and Colvin, L. B. "A Computer Program for Beta Emitters Employing Liquid Scintillation Counting Systems." Atompraxis 13, No. 1, 1967.

Creger, C. R., Colvin, L. B. and Couch, J. R. "Absorption, Deposition and Excretion of Sr^{89} by the Chick in Relation to Route of Administration." Proceedings of the Society for Experimental Biology and Medicine, v124, 1967.

Colvin, L. B., Creger, C. R. and Couch, J. R. "Effects of Sodium Alginate on Absorption and Deposition of Radioactive Cations in the Chick." Proceedings of the Society for Experimental Biology and Medicine, v124, 1967.

Creger, C. R., Ansari, M. N. A., Couch, J. R. and Colvin, L. B. "The Determination of Sr^{89} in Biological Samples." International Journal of Applied Radiation and Isotopes, Vol. 18, 1967.

Ansari, M. N. A., Creger, C. R., Colvin, L. B., Allen, W. S. and Couch, J. R. "Turnover Rate and Distribution Pattern of Radiostrontium in the Skeleton of the Laying Hen." Proceedings of the Society for Experimental Biology and Medicine, Vol. 123, 1966.

Colvin, L. B., Creger, C. R., Couch, J. R., Ferguson, T. M. and Ansari, M. N. A. "A Simplified Method for Separation of Urine and Feces in the Immature Fowl." Proceedings of the Society for Experimental Biology and Medicine, Vol. 123, 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00354

Publications (Continued)

Colvin, L. B., Creger, C. R., Couch, J. R. and Ansari, M. N. A. "Effects of Hydrobiotites on Sr^{89} Absorption and Deposition in Chicks." Proceedings of the Society for Experimental Biology and Medicine, Vol. 122, 1966.

RH 00358 EFFECTS OF HIGH ENERGY RADIATIONS ON LIPIDS

Jacques R. Chipault, Ph.D.
The Hormel Institute
University of Minnesota
Minneapolis, Minnesota

Descriptor

Lipids of increasing complexity from simple methyl esters of saturated fatty acids to glycerides, phospholipids, glyceryl ethers and other complex lipid components of living tissues will be subjected to high energy radiations under various conditions. Lipid breakdown and reaction products will be isolated and studied to determine basic changes resulting directly from irradiation. Changes in physical properties of these compounds will be investigated also. The effect of irradiated lipids on vital micro-components of biological tissue such as hormones, vitamins, enzymes, etc., will be studied also in an effort to determine the role of lipids in in vivo irradiation damage.

Publications

No publications received.

RH 00367 BIOLOGICAL MECHANISMS OF RADIATION DAMAGE

William O. Caster, Ph.D.
Dept. of Foods & Nutrition
University of Georgia
Athens, Georgia

Descriptor

White rats are utilized in determining the biological mechanisms of radiation damage. Alterations in tissue weight, DNA synthesis, intestinal transport, and electrolyte

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00367

Descriptor (Continued)
balance, ECG and other parameters will be measured after irradiation of 700R to the total body and 2,000R to the head is used. Results will be correlated with each other and with evidences of nervous and hormonal changes.

Publications
No publications received.

RH 00379 RADIATION CHEMISTRY OF SULFUR BIOCHEMICALS

Terence C. Owen, Ph.D.
Dept. of Chemistry
University of South Florida
Tampa, Florida

Descriptor
This study is to determine the products of X-irradiation of sulfur biochemicals, especially peptides containing disulfide and mixed-disulfide linkages. Variables to be studied include pH, concentration, radiation dose, dose rate, oxygen tension, and location and substitution of the disulfide group. Particularly featured are studies at low doses, extending to about 500-1000 rads.

Publications
No publications received.

RH 00403 IMMUNOGENETIC STUDY OF RADIATION BONE MARROW THERAPY

Don H. Shaw, B.S.
Dept. of Natural Sciences
Carver Research Foundation
of Tuskegee Institute
Alabama

Descriptor
The aim of this project is to elucidate further the dynamics of hemopoietic repopulation following lethal total-body irradiation and bone marrow trans-

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00403

Descriptor (Continued)
plantation. The information resulting should be valuable in studying basic concepts of immunogenetics.

Publications
No publications received.

RH 00405 — ESR STUDIES OF CONJUGATION BY SULFUR

Robert G. Hayes, Ph.D.
Dept. of Chemistry
University of Notre Dame
Notre Dame, Indiana

Descriptor
The objective of this research is the elucidation of the role of sulfur-containing groups in conjugation.

Publications
No publications received.

RH 00418 — EFFECT OF MICROBIAL ANTIGENS ON IRRADIATED MICE

Alice M. Savage, Ph.D.
Dept. of Biology
Muhlenberg College
Allentown, Pennsylvania

Descriptor
A study will be made of the effect of treatment with microbial antigens on damage to defense mechanisms following a lethal dose of X-irradiation. Work on hematopoietic recovery of vaccine-treated lethally X-irradiated mice will be continued utilizing histochemistry and electron microscopy.

Publications
No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00422 — PHOTOENZYMIC REPAIR OF RADIATION-DAMAGED NUCLEIC ACID

Claud S. Rupert, Ph.D.
Division of Biology
Southwest Center for Advanced Studies
Dallas, Texas

Descriptor

This research studies the mechanism of photoenzymatic process repairing UV-irradiated DNA in vitro, and its relation to cellular recovery under laboratory and natural conditions. It encompasses efforts to isolate and chemically define the substrate for this enzyme from irradiated synthetic polynucleotides.

Publications

Wang, S. Y., Patrick, M. H., Varghese, A. J. and Rupert, C. S. "Concerning the Mechanism of Formation of UV-Induced Thymine Photoproducts in DNA." Proceedings of National Academy of Sciences, Vol. 57, No. 2, February 1967.

RH 00429 — CHELATION IN RADIATION PROTECTION CHEMICALS

Seymour S. Block, Ph.D.
Dept. of Chemical Engineering
University of Florida
Gainesville, Florida

Descriptor

The objective of this project is to better understand the mechanism of chemical protectants against ionizing radiation and to be able to produce more effective and useful materials. Materials will be synthesized that have the same reactive structure and are known to chelate and be radioprotective but to introduce substitutents in the nonreactive part of the molecule, which will influence the electrical properties and thereby the ability to chelate.

Publications

Block S. S. and Weidner, J. P. "Trifluoromethyl Thiolsulphonates." Nature, Vol. 214, No. 5087, April 29, 1967.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00430 CELLULAR LOCALIZATION OF XENON BY MICRORADIOGRAPHY

Robert J. Schulz, M.S.
Dept. of Radiology
Albert Einstein College of
Medicine of Yeshiva University
Bronx, New York

Descriptor
The objective of this research is to localize xenon in the mammalian cell and from the pattern of localization, to draw conclusions about the mechanisms involved when it protects these cells from ionizing radiation.

Publications
No publications received.

RH 00437 STUDY OF RADIATION EFFECTS ON CHROMOSOMES

Shigefumi Okada, Ph.D.
Dept. of Radiology
University of Rochester
Rochester, New York

Descriptor
The ultimate objective is to explain at the molecular level various radiobiological phenomena, such as cell death, mitotic delay, giant cells, chromosome aberrations, etc.

Publications
No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00455 — COMPARATIVE EFFECTS OF TWO RADIATION EXPOSURE REGIMES

Donald G. Willhoit, Sc.D.
Dept. of Environmental Sciences & Engineering
University of North Carolina
Chapel Hill, North Carolina

Descriptor
This research investigates the influence of the dose fractionation regime on biological response to protracted radiation. Lethality and hematological changes in mice exposed to gamma rays under different dose protraction regimes is being studied.

Publications
No publications received.

RH 00479 — HEMATOLOGIC RESPONSES TO NON-HOMOGENEOUS IRRADIATION

Donald G. Willhoit, Sc.D.
Dept. of Environmental Sciences & Engineering
University of North Carolina
Chapel Hill, North Carolina

Descriptor
This research is investigating the relationship of the change in peripheral blood in rats following exposure to graded levels of partial body and non-homogeneous X-irradiation.

Publications
No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00482 — CYSTEAMINE AND X-RAYS PRENATALLY: BEHAVIOR OF THE RAT

Joan M. Havlena, Ph.D.
Dept. of Oral Biology
University of Detroit
Detroit, Michigan

Descriptor
This research investigates the radioprotective capabilities of cysteamine on other than motor performance explored on the days of gestation when other nervous tissues of the fetus are sensitive to the effects of ionizing radiation. Tests of reaction time, color discrimination and learning ability of the offspring will be evaluated. Rats will be utilized with 185R being administered.

Publications
No publications received.

RH 00483 — ALTERATION OF GENETIC REPLICATION

Walter J. Burdette, Ph.D., M.D.
Dept. of Surgery & Office of Research
University of Texas M. D. Anderson Hospital & Tumor Inst.
Houston, Texas

Descriptor
Dominant lethals in mice are being used as an indicator for the effect of antibiotics on mutations. It appears that there may be some shift in the sensitivity to irradiation during different stages in spermatogenesis when Actinomycin-D is administered. Currently the effect of time of administration and oxygen tension are being tested.

Publications
No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00488* MERCAPTOCYCLOPROPYLAMINE: RADIATION-PROTECTIVE AGENTS

Donald T. Witiak, Ph.D.
College of Pharmacy
University of Iowa
Iowa City, Iowa

Descriptor
This program is designed to study the synthesis of mercapto compounds and to evaluate these compounds in terms of their ability to protect mice from the effect of ionizing radiation.

Publications
No publications received.

RH 00528 (Formerly RH 00324) AMINOTHIONIMIDES AS RADIATION PROTECTIVE AGENTS

Donald T. Witiak, Ph.D.
College of Pharmacy
Ohio State University
Columbus, Ohio

Descriptor
This research concerns the synthesis and biological evaluation of various radiation protecting substances. Electron spin resonance and other measurements are made to yield information about the in vivo mechanism.

Publications
No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

MECHANISMS OF RADIATION DAMAGE (Continued)

RH 00529 (Formerly RH 00488)

MERCAPTOCYCLOPROPYLAMINE: RADIATION-PROTECTIVE AGENTS

Donald T. Witiak, Ph.D.
College of Pharmacy
Ohio State University
Columbus, Ohio

Descriptor
This program is designed to study the synthesis of mercapto compounds and to evaluate these compounds in terms of their ability to protect mice from the effect of ionizing radiation.

Publications
No publications received.

STUDIES IN BASIC RADIATION PHYSICS & CHEMISTRY

RH 00008

STUDIES OF RADIATION DAMAGE TO BIOLOGICAL MATERIALS

Roy S. Anderson, Ph.D.
Dept. of Physics
Clark University
Worcester, Massachusetts

Descriptor
Electron spin resonance spectroscopy is employed to identify the specific effect of radiation damage to molecules of biological interest. Single crystals of biological material are grown and exposed to ultraviolet, X, gamma and neutron radiation. Recovery processes and rates are revealed by repeated observation over long periods following irradiation.

Publications
DuVarney, R. C. and Kohin, R. P. "Ammonio-Group β-Proton Hyperfine Coupling Constants in π-Electron Radicals." The Journal of Chemical Physics, Vol. 44, No. 6, March 15, 1966.

GRANT NO. TITLE OF PROJECT AND PUBLICATIONS

PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES IN BASIC RADIATION PHYSICS & CHEMISTRY (Continued)

RH 00008 Publications (Continued)

Kohin, R. P. and Nadeau, P. G. "Electron Spin Resonance Studies of Υ-Irradiated Ferroelectric Methylammonium Alum Crystals." The Journal of Chemical Physics, Vol. 44, No. 2, January 15, 1966.

Rao, M. J. and Anderson, R. S. "Electron Spin Resonance in Gamma-Irradiated Single Crystals of Hydroxylated Organic Compounds." The Journal of Chemical Physics, Vol. 42, No. 8, April 15, 1965.

RH 00099 RBE OF MONOENERGETIC NEUTRONS

Harald H. Rossi, Ph.D.
Dept. of Radiology
Columbia University
New York, New York

Descriptor

It is proposed to investigate the relative biological effectiveness of gamma rays, X-rays, and fast neutrons in the energy range from about 100 Kev to 16 Mev. Biological end-points will include: reduction of resting primary spermatocytes in the mouse, induction of lenticular opacities in the mouse (particularly at small doses), radiation induced mutations in plants and lethal effects on insects.

Publications

Smith, H. H. and Rossi, H. H. "Energy Requirements and Relative Biological Effectiveness for Producing a Cytogenetic Phenomenon in Maize by Irradiating Seeds with X-Rays and Monoenergetic Neutrons." Radiation Research, Vol. 28, No. 2, June 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES IN BASIC RADIATION PHYSICS & CHEMISTRY (Continued)

RH 00206 RADIATION EFFECTS IN HETEROGENEOUS SYSTEMS

Francis J. Johnston, Ph.D.
Dept. of Chemistry
University of Georgia
Athens, Georgia

Descriptor
This project is concerned with physical and chemical changes produced in colloidal systems by ionizing radiation. Light scattering and spectrophotometric techniques are being used to measure particle size changes and reaction rates. Electron spin resonance measurements are being used to observe production and reaction of radicals in solid matrixes of biologically significant materials.

Publications
Janzen, E. G., Johnston, F. J. and Ayers, C. L. "The Reversible Thermal Decomposition of Triphenylmethylperoxy Radical to Triphenylmethyl Radical and Oxygen." Journal of the American Chemical Society, 89, 1176, 1967.

RH 00253 MEASUREMENT OF NEUTRON SPECTRA IN BIOLOGICAL SHIELDS

John S. King, Ph.D.
Dept. of Nuclear Engineering
University of Michigan
Ann Arbor, Michigan

Descriptor
The research objective is to make direct measurements of the space-dependent neutron energy spectra in the energy range 1.0 to 16.0 MEV for neutrons penetrating shielding materials surrounding the reactor. The data will be used in computer shielding codes.

Publications
Harris, Jr., L., Sherwood, G. and King, J. S. "Fast-Neutron Spectra in Water and Graphite." Nuclear Science and Engineering, 26, 1966.

Harris, Jr., L., Knoll, G. F. and King, J. S. "Proton-Recoil Spectrometer for Fast Neutron Spectra." Transactions of the American Nuclear Society, 8, 73, June 1965.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES IN BASIC RADIATION PHYSICS & CHEMISTRY (Continued)

RH 00384 — RADIATION DAMAGE MECHANISMS IN BIOLOGICAL MATERIALS

John R. Rowlands, Ph.D.
Dept. of Physical & Biological Sciences
Southwest Research Institute
San Antonio, Texas

Descriptor

Electron spin resonance studies of radiation-induced reactions and biological materials are being made. The procedure followed will involve radiation of single crystals of these materials in order that the identification of radicals and electron transfer processes is enhanced.

Publications

Cadena, Jr., D. G. and Rowlands, J. R. "An Electron Spin Resonance Study of γ-Irradiated Polycrystalline n-Propane-arsonic Acid." Journal of the Chemical Society, Section B, 1967.

RH 00386 — RADIATION INDUCED CELL DEATH AT VERY LOW TEMPERATURES

Robert H. Fetner, Ph.D.
Georgia Institute of Technology
Atlanta, Georgia

Descriptor

Comparative studies will be made of irradiated cell populations at room temperature and in liquid nitrogen. Reproductive cell death as a function of dose will be compared and related to possible mechanisms, chromosome breakage, mitotic inhibitions and centriole damage at the different temperatures.

Publications

No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES IN BASIC RADIATION PHYSICS & CHEMISTRY (Continued)

RH 00392 — EFFECT OF RADIATION ON PROTEINS AND RELATED COMPOUNDS

William F. Forbes, Ph.D., D.Sc.
Dept. of Biochemistry
University of Rochester
Rochester, New York

Descriptor

The effects of radiation and aging are studied, on the molecular level, for certain proteins. Possible reaction intermediates, formed on irradiation and in other ways, are determined by electron spin resonance spectroscopy. The substances investigated are mainly eye lens proteins, collagen fractions and model compounds, including amino acids and hydrocarbons containing unpaired electrons.

Publications

Forbes, W. F. and Robinson, J. C. "Electron Spin Resonance Spectra of Heated Polynuclear Hydrocarbons." Nature, Vol. 214, No. 5083, April 1, 1967.

Forbes, W. F., Robinson, J. C. and Wright, G. F. "Free Radicals of Biological Interest, Part I. Electron Spin Resonance Spectra of Tobacco Smoke Condensates." Canadian Journal of Biochemistry, Vol. 45, 1087, 1967.

Lerman, S., Zigman, S. and Forbes, W. F. "Properties of a Cryoprotein in the Ocular Lens." Biochemical and Biophysical Research Communications, Vol. 22, No. 1, 1966.

Forbes, W. F. and Sullivan, P. D. "The Effect of Radiation on Collagen, I. Electron-Spin Resonance Spectra of 2537-Å-Irradiated Collagen." Biochimica et Biophysica Acta, Vol. 120, 222, 1966.

Forbes, W. F. and Lerman, S. "Effect of Radiation and Aging on Ocular Lens Proteins." Proceedings of 7th International Congress of Gerontology, Vienna, Austria, June 26 - July 2, 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES IN BASIC RADIATION PHYSICS & CHEMISTRY (Continued)

RH 00392

Publications (Continued)
Lerman, S., Forbes, W. F. and Zigman, S. "Further Studies on Gamma Crystallin of the Ocular Lens." Federation Proceedings, Vol. 25, No. 2, March-April 1966.

RH 00394

RADIOLOYSIS OF SIMPLE ORGANIC NITROGEN COMPOUNDS

Norman N. Lichtin, Ph.D.
Dept. of Chemistry
Boston University
Boston, Massachusetts

Descriptor
This study deals with measuring the basic parameters, such as EPR of various nitrogen compounds. Mechanistic evidence will be looked for as well as the effect of various scavengers, such as O_2, N_2O, and H^+.

Publications
No publications received.

RH 00433

RADIATION STUDIES IN IONIC MATRICES

I. C. Hisatsune, Ph.D.
Dept. of Chemistry
Pennsylvania State University
University Park, Pennsylvania

Descriptor
Biologically significant inorganic and organic compounds will be dispersed in ionic matrices. The radiation chemistry of such compounds will be investigated by exposing these pressed discs to ionizing radiations and following the chemical changes produced in them by IR, UV-visible and electron paramagnetic resonance spectroscopies.

Publications
No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES IN BASIC RADIATION PHYSICS & CHEMISTRY (Continued)

RH 00434 — RADIATION CHEMICAL STUDIES ON HEMOCYANINS

Jack Schubert, Ph.D.
Dept. of Occupational Health
University of Pittsburgh
Pittsburgh, Pennsylvania

Descriptor

This grant will study the effects of ionizing radiations of varying LET on the radiosensitive oxygenation reactions of solutions containing the copper containing oxygen-carrier, hemocyanin. This research will study the oxygen effect; the interaction of chelating resonance agents and the reactive site; protective and sensitizing mechanisms capable of being described on a molecular basis; chemical changes induced by radiation in relation to catalase action of a protein and chelate; etc.

Publications

Schubert, J. and White, E. R. "Radiation of Hemocyanin: Inactivation and Reactivation of Oxygen-Carrying Capacity." Science, Vol. 155, No. 3765, February 24, 1967.

RH 00450 — TRANSFER MECHANISMS IN IRRADIATED BIOLOGICAL SYSTEMS

Harold C. Box, Ph.D.
Health Research, Inc.
Roswell Park Division
Buffalo, New York

Descriptor

Two transfer processes occurring in irradiated substances will be studied. These processes are: 1. the transfer of electrons resulting from broken bonds in irradiated sulfur compounds; 2. the transfer of energy which produces excited states in irradiated ring compounds. The investigation will utilize a combination of specially adapted cryogenic and magnetic resonance equipment designed for the study of transient paramagnetic signals in small biological samples.

Publications

No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES IN BASIC RADIATION PHYSICS & CHEMISTRY (Continued)

RH 00464 — ESR ABSORPTION OF IRRADIATED ORGANIC CRYSTALS

Ichiro Miyagawa, Dr.S.
Dept. of Physics
University of Alabama
University, Alabama

Descriptor
ESR observation of irradiated crystals of organic compounds will be studied in order to clarify the phenomena of C-H hydrogen of radicals in irradiated crystals of amino acids, exchanging easily with deuterium of the host crystal. This information will be useful for interpretation of radiation damage of organic compounds of biological systems.

Publications
No publications received.

RH 00499 — EFFECTS OF PROTON IRRADIATION

John J. Ghidoni, M.D.
Dept. of Pathology
Baylor University College of Medicine
Houston, Texas

Descriptor
Groups of Macaca mulatta monkeys had received whole-body irradiation with protons of differing energies, (32, 55, 138 and 400 Mev and 2.2 Bev). These animals were serially killed and tissues were preserved. This research will examine, by electron microscope and other techniques, the morphological parameters of cellular alterations.

Publications
No publications received.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF NON-IONIZING RADIATION

RH 00302 LASER RADIATION IN PHOTOCHEMISTRY

Karl Weiss, Ph.D.
Dept. of Chemistry
Northeastern University
Boston, Massachusetts

Descriptor
This research investigated the absorption, energy transfer and chemical processes which occur with laser radiation. Simple model chemical systems are utilized to elucidate the processes which occur. Investigations are also carried out on laser photolysis of charge transfer complexes, a class of compounds which participate in energy exchange in biological systems.

Publications
Moreau, W. M., Tyler, T. A. and Weiss, K. "Transfer Apparatus for Degassed Solutions." Journal of Chemical Education, Vol. 43, No. 8, August 1966.

RH 00361* EFFECTS AND HAZARDS OF HIGH PEAK POWER LASERS

Samuel Fine, S.M., M.D.
Dept. of Electrical Engineering
Northeastern University
Boston, Massachusetts

Descriptor
The objectives of these studies are to determine the mechanisms of energy transformation in the interaction of high peak power density radiation with biological systems, as made available by lasers. Both analytic and experimental approaches will be carried out.

Publications
Lobene, R. R. and Fine, S. "Interaction of Laser Radiation with Oral Hard Tissues." The Journal of Prosthetic Dentistry, Vol. 16, No. 3, May-June 1966.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

STUDIES OF NON-IONIZING RADIATION (Continued)

RH 00361*

Publications (Continued)

Fine, S., Klein, E., Peacock, G. R., Fine, B. S., Hansen, W. P. and Litwin, M. D. "Control of Laser Hazards and Management of Accidents." Seminar on Laser Safety at the Martin Company, Orlando, Florida, May 19-20, 1966.

Klein, E., Laor, Y., Simpson, L. C., Fine, S., Edlow, J. and Litwin, M. "Threshold Studies and Reversible Depigmentation in Rodent Skin." Northeast Electronics Research and Engineering Meeting, November 3-5, 1965.

Hansen, W. P., Fine, S., Peacock, G. R. and Klein, E. "Focusing of Laser Light by Target Surfaces and Effects on Initial Temperature Conditions." Northeast Electronics Research and Engineering Meeting, November 3-5, 1965.

Laor, Y., Simpson, C. L., Klein, E. and Fine, S. "The Pathology of Laser Irradiation of the Skin and Body Wall of the Mouse." The American Journal of Pathology, Vol. 47, No. 4, October 1965.

Stratton, K., Pathak, M. A. and Fine, S. "ESR Studies of Melanin Containing Tissues After Laser Irradiation." Northeast Electronics Research and Engineering Meeting, November 3-5, 1965.

Fine, S. and Klein, E. "Ultraviolet Lasers." The First Conference on the Biologic Effects of Ultraviolet Radiation.

BENEFICIAL APPLICATIONS OF RADIATION

RH 00061 — IMPROVEMENT IN SANITATION BY IONIZING RADIATION

Samuel A. Goldblith, Ph.D.
Dept. of Nutrition & Food Science
Massachusetts Institute of Tech.
Cambridge, Massachusetts

Descriptor

This research is elucidating the factors which contribute to the survival of micro-

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

BENEFICIAL APPLICATIONS OF RADIATION (Continued)

RH 00061

Descriptor (Continued)
organisms exposed to ionizing radiation. Radiosensitizers and the extremely resistant vegetative coccus are also part of this study.

Publications
No additional publications.

RH 00204 BIOLOGICAL EFFECTS OF LOW VELOCITY ELECTRONS

George S. Sperti, Sc.D.
Div. of Physics & Biophysics
Institutum Divi Thomae
Cincinnati, Ohio

Descriptor
The electron effect is being compared in the inactivation and killing of Staphylococcus albus and Saccharomyces cerevisiae with that caused by ultraviolet irradiation. Likewise the effect of low velocity electrons on enzymes in crystalline form is being investigated.

Publications
Fitzpatrick, Sister M. A., Sperti, G. S. and D'Souza, L. "Biological Effects of Low Velocity Electrons." Archives of Biochemistry and Biophysics, Vol. 117, No. 3, December 1966.

RH 00311 IRRADIATION AND MARROW TRANSPLANTATION IN LARGE ANIMALS

Edward D. Thomas, M.D.
Dept. of Medicine
University of Washington
Seattle, Washington

Descr ptor
This research studies a number of interrelated problems concerned with whole-body irr diation and grafting of bone marrow and other organs. Histocompatibility typing wi n the aim of selecting donors and recipients of reasonable compatibility before the

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

BENEFICIAL APPLICATIONS OF RADIATION (Continued)

RH 00311

Descriptor (Continued)
effect of grafting; a study of the pathophysiology and the immunological reaction between graft-host and other factors will be studied. Work will be carried out on large animals, such as dogs and baboons. Special techniques to be employed include cross-circulation and extracorporeal irradiation.

Publications

Epstein, R. B., Bryant, J. and Thomas, E. D. "Cytogenetic Demonstration of Permanent Tolerance in Adult Outbred Dogs." Transplantation, Vol. 5, No. 2, 1967.

Burnell, J. M., Dawborn, J. K., Epstein, R. B., Gutman, R. A., Leinbach, G. E., Thomas, E. D. and Volwiler, W. "Acute Hepatic Coma Treated by Cross-Circulation or Exchange Transfusion." New England Journal of Medicine, 276, April 27, 1967.

Pillow, R. P., Epstein, R. B., Buckner, C. D., Giblett, E. R. and Thomas, E. D. "Treatment of Bone-Marrow Failure by Isogeneic Marrow Infusion." New England Journal of Medicine 275, July 14, 1966.

Epstein, R. B., Graham, T. C., Buckner, C. D., Bryant, J. and Thomas, E. D. "Allogeneic Marrow Engraftment by Cross Circulation in Lethally Irradiated Dogs." Blood 28:692-707, 1966.

Thomas, E. D., Plain, G. L., Graham, T. C. and Ferrebee, J. W. "Long-Term Survival of Lethally Irradiated Dogs Given Homografts of Bone Marrow." Blood, Vol. 23, No. 4, April 1964.

GRANT NO.	TITLE OF PROJECT AND PUBLICATIONS	PRINCIPAL INVESTIGATOR AND LOCATION

RADIATION CONFERENCES AND SEMINARS

RH 00076 RADIOBIOLOGICAL RESEARCH ON MARINE ORGANISMS

Philip B. Armstrong, M.D.
Marine Biological Laboratory
Woods Hole, Massachusetts

Descriptor
This grant is to provide radiobiological facilities to be used by investigators in marine research.

Publications
No publications received.

RH 00395 PEDIATRIC SIGNIFICANCE OF PEACETIME FALLOUT

Lee E. Farr, M.D.
American Academy of Pediatrics
Evanston, Illinois

Descriptor
This conference of leading pediatricians was called to determine the pediatric significance of peacetime fallout which included fallout activity in food, water and milk. Measures taken by various government agencies to alleviate problems, to disseminate quick, early information and actions that would go into effect, were also evaluated.

Publications
No publications received.

APPENDIX A

LISTING BY GEOGRAPHICAL AREA

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Arkansas	46
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Colorado	23, 35
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District of Columbia	5
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Georgia	11, 32, 58, 68, 69
Illinois	4, 7, 18, 27, 31, 47, 50, 52, 78
Indiana	12, 15, 39, 48, 51, 60
Iowa	24, 39, 55, 65
Kentucky	46
Louisiana	19
Maine	40
Maryland	6, 29
Massachusetts	22, 30, 33, 38, 52, 66, 71, 74(2), 75, 78
Michigan	33, 38, 49, 64, 68
Minnesota	58
Missouri	17, 21, 40, 54, 56
Nevada	16
New Mexico	8
New York	5, 10, 18, 20, 25, 27, 36, 42, 43, 53, 62(2), 67, 70, 72
North Carolina	63(2)
Ohio	14, 65, 66, 76
Oklahoma	53
Oregon	50

STATE - COUNTRY	PAGE NO.
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South Dakota	37
Tennessee	22, 24
Texas	35, 36, 56, 61, 64, 69, 73
Utah	9, 10
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APPENDIX B

NUMERICAL LISTING

GRANT NUMBER	PAGE NO.	GRANT NUMBER	PAGE NO.
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RH 00061	75	RH 00246	50
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RH 00076	78	RH 00253	68
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RH 00081	25	RH 00268	50
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RH 00113	3	RH 00297	52
RH 00117	11	RH 00298	20
RH 00124	14	RH 00302	74
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RH 00197	46	RH 00306	33
RH 00204	76	RH 00307	13
RH 00206	68	RH 00309	33
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RH 00210	18	RH 00312	53
RH 00211	15	RH 00316	21

GRANT NUMBER	PAGE NO.
RH 00318	54
RH 00321	54
RH 00322	15
RH 00324	55
RH 00325	55
RH 00328	35
RH 00330	35
RH 00345	36
RH 00347	56
RH 00350	4
RH 00354	56
RH 00358	58
RH 00361	74
RH 00364	36
RH 00366	8
RH 00367	58
RH 00379	59
RH 00384	69
RH 00386	69
RH 00390	37
RH 00391	37
RH 00392	70
RH 00394	71
RH 00395	78
RH 00400	38
RH 00403	59
RH 00404	8
RH 00405	60
RH 00412	10
RH 00416	4
RH 00418	60
RH 00422	61
RH 00428	5
RH 00429	61
RH 00430	62
RH 00431	5
RH 00433	71
RH 00434	72
RH 00437	62
RH 00443	6
RH 00447	16
RH 00450	72
RH 00455	63
RH 00461	21
RH 00464	73
RH 00467	38
RH 00470	9
RH 00473	39
RH 00474	39
RH 00479	63
RH 00482	64
RH 00483	64
RH 00487	40
RH 00488	65
RH 00494	22
RH 00496	40
RH 00499	73
RH 00528	65
RH 00529	66

APPENDIX C

ALPHABETICAL LISTING OF PRINCIPAL INVESTIGATORS

NAME	GRANT NO.	PAGE NO.
ALBERT, Roy E.	RH 00298	20
AMATO, Charles G.	RH 00428	5
ANDELMAN, Julian B.	RH 00322	15
ANDERSON, Roy S.	RH 00008	66
ARCHER, Ellen G.	RH 00496	40
ARMSTRONG, Philip B.	RH 00076	78
BEAM, Carl A.	RH 00312	53
BLOCK, Seymour S.	RH 00429	61
BOX, Harold C.	RH 00450	72
BURDETTE, Walter J.	RH 00483	64
CASTER, William O.	RH 00367	58
CHANG, M. C.	RH 00309*	33
CHIPAULT, Jacques R.	RH 00358	58
CHRISTIAN, John E.	RH 00211	15
CONTE, Frank P.	RH 00246	50
COVIELLO, Dominick A.	RH 00293	52
CREGER, Clarence R.	RH 00354	56
DAVIS, Robert E.	RH 00279	51
DAVIS, Roger T.	RH 00391	37
DIMAGGIO, Anthony	RH 00252	19
FARR, Lee E.	RH 00395	78
FETNER, Robert H.	RH 00386	69
FINE, Samuel	RH 00361*	74
FORBES, P. Donald	RH 00390	37
FORBES, William F.	RH 00392	70
FOYE, William O.	RH 00297	52
FURCHGOTT, Ernest	RH 00065	24
GARCIA, John	RH 00467	38
GHIDONI, John J.	RH 00499	73
GOEPP, Robert A.	RH 00268	50
GOLDBLITH, Samuel A.	RH 00061	75
GOODNIGHT, Clarence J.	RH 00215*	12
GORIN, George	RH 00305	53
GOWEN, John W.	RH 00328	35
GREEN, Morris	RH 00345	36
GRIEM, Melvin L.	RH 00207*	18
GRIFFEN, Allen B.	RH 00487	40
HALE, John	RH 00443	6
HAVLENA, Joan M.	RH 00306*	33
HAVLENA, Joan M.	RH 00482	64
HAYES, Robert G.	RH 00405	60
HAYMOND, Herman R.	RH 00005	41
HEMPELMANN, Louis H.	RH 00210	18
HEUSNER, William W.	RH 00400	38
HEYSSEL, Robert M.	RH 00303	22
HISATSUNE, I. C.	RH 00433	71
HORTA, Jorge da Silva	RH 00039	16
HOWARTH, John L.	RH 00404	8

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NAME	GRANT NO.	PAGE NO.
JANOWER, Murray L.	RH 00494	22
JOFTES, David L.	RH 00243	30
JOHNSTON, Francis J.	RH 00206	68
KING, John S.	RH 00253	68
KRISE, George M.	RH 00330	35
KUNTZ, Robert R.	RH 00321	54
LEE, Hun	RH 00470	9
LICHTIN, Norman N.	RH 00394	71
LOHMANN, Wolfgang H.	RH 00197*	46
LOHMANN, Wolfgang H.	RH 00474	39
MALKINSON, Frederick D.	RH 00280	31
MCQUADE, Henry A.	RH 00347	56
MENCZER, Leonard F.	RH 00260*	20
MIETTINEN, Jorma K.	RH 00307	13
MILLER, R. H.	RH 00124	14
MITTLER, Sidney	RH 00140	27
MIYAGAWA, Ichiro	RH 00464	73
MIZELL, Sherwin	RH 00473	39
MONESI, Valerio	RH 00304	32
MORENG, Robert E.	RH 00001*	23
MORGAN, Russell H.	RH 00085*	6
OHIRA, Masahika	RH 00316	21
OKADA, Shigefumi	RH 00437	62
OSBORNE, James W.	RH 00021	24
OWEN, Terence C.	RH 00379	59
PENDLETON, Robert C.	RH 00030	10
PIHL, Alexander	RH 00098	44
PLUMMER, Gayther L.	RH 00117*	11
REMENCHIK, Alexander P.	RH 00283*	7
RICHARDS, Albert G.	RH 00113*	3
ROBERTS) Formerly	RH 00306*	33
ROBERTS) Havlena	RH 00482	64
ROSENTHAL, Harold L.	RH 00112*	17
ROSENTHAL, Harold L.	RH 00461	21
ROSSI, Harald H.	RH 00099	67
ROTBLAT, Joseph	RH 00272	30
ROWLANDS, John R.	RH 00384	69
RUGH, Roberts	RH 00081	25
RUGH, Roberts	RH 00097*	27
RUPERT, Claud S.	RH 00221*	29
RUPERT, Claud S.	RH 00422	61
SAVAGE, Alice M.	RH 00418	60
SAX, Karl	RH 00294	32
SAX, N. Irving	RH 00412	10
SCHUBERT, Jack	RH 00434	72
SCHULZ, Robert J.	RH 00430	62
SHAW, Don H.	RH 00403	59
SHEER, Daniel E.	RH 00364	36
SIGLER, William F.	RH 00077*	9
SLOBODIAN, Evelyn	RH 00095	43
SMITH, Edward M.	RH 00416	4
SMITH, Walter T.	RH 00193	46
SPEIDEL, Carl C.	RH 00325*	55
SPENCER, Herta	RH 00222	47
SPERTI, George S.	RH 00204	76
STRAIN, William H.	RH 00042	42
TARACHNICK, Joseph	RH 00218	28
TAYLOR, Lauriston S.	RH 00431	5
THOMAS, Edward D.	RH 00311	76

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NAME	GRANT NO.	PAGE NO.
WANG, Yen	RH 00350	4
WEETH, Howard H.	RH 00447	16
WEISS, Karl	RH 00302	74
WELLER, Richard I.	RH 00366	8
WHIPPLE, G. Hoyt	RH 00245	49
WILLHOIT, Donald G.	RH 00455	63
WILLHOIT, Donald G.	RH 00479	63
WILLIAMS, Edwin G.	RH 00175	12
WILSON, Raphael	RH 00039	48
WITIAK, Donald T.	RH 00324*	55
WITIAK, Donald T.	RH 00488*	65
WITIAK, Donald T.	RH 00528	65
WITIAK, Donald T.	RH 00529	66
WOOLES, Wallace R.	RH 00318	54

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